

INSTRUCTION BOOK

**QUAD 22 CONTROL UNIT**

**AND**

**QUAD II POWER AMPLIFIER**





# **QUAD 22 CONTROL UNIT**

## **QUAD II POWER AMPLIFIER**

### **INSTALLATION AND OPERATION**

WHEN installing this amplifier it should be borne in mind that the standard of performance of the complete equipment is limited by that of the poorest component part. Thus the gramophone motor and pickup, loudspeaker, etc., should all receive careful consideration if full advantage is to be taken of the capabilities of the amplifier.

## INSTALLATION

The QUAD 22 Control Unit may be used with a single QUAD II Power Amplifier for single channel installation, or with two QUAD II Power Amplifiers to provide single channel and stereo reproduction.

The Power Amplifiers contain no operating controls, so they may be mounted out of sight, usually in the bottom of the cabinet or other housing for the complete equipment.

Adequate ventilation should be provided. If the available space is large, ventilation may be provided by a perforated back or by openings near the bottom and top of the back, making sure that these openings are not blocked by placing the cabinet against a wall. When a compact installation is required considerable care is needed in ventilation design to make use of "chimney" effects.

Problems of installation will be eased if the power amplifiers are at least 2 feet from gramophone pickups, pickup transformers and tape heads.

The fuse, fuseholder cap and voltage adjusting screw are removed before packing to avoid transit damage and should be re-inserted upon installation.

Two fixing screws are provided with each power amplifier so that it may be fastened in position.

The Control Unit may be mounted in a cabinet panel of any thickness up to  $\frac{3}{4}$ " (20mm.) in a position decided by ease of handling and aesthetic considerations. It may be horizontal, vertical or in any other position. It is neither susceptible to, nor causes interference in associated equipment.

A 10" x 3 1/16" (254 x 78mm.) opening with  $\frac{1}{4}$ " (6mm.) radius corners should be cut in the panel as shown in the template contained in the rear of this booklet.

Remove the two screws from the rear of the cover and slide the cover off.

Insert Tuner, leads first, into the cut-out from the front. The lugs on the rear of the Tuner front panel should locate inside the cut-out.

Replace the cover from the rear, making sure that the leads are not trapped. Insert the two screws and tighten until the Tuner is just held in position, then give one additional turn to lock securely.

## Loudspeaker Connections

The proper placing of loudspeakers is extremely important and will inevitably entail experimentation. A separate section is devoted to this subject. Initially, however, an approximate position should be chosen for the speakers and since one of the services available with the control unit is to provide single channel on one loudspeaker, it is necessary to decide which of the loudspeakers is to be operative on this service. In order to comply with a colour coding used throughout the equipment, the single channel speaker should now be designated "Yellow" and the other speaker designated "Blue."

The two loudspeakers should now each be connected to one of the two power amplifiers making sure that the two pairs of wires are both connected in the same way (correctly phased). For example if the top terminal of

one amplifier is connected to the right hand terminal of one loudspeaker, then the other loudspeaker and amplifier should be similarly wired. Should there be any doubt or the loudspeakers dissimilar, this point may be ignored at this stage and subsequently checked and corrected if necessary when the equipment is operating.

The loudspeakers should have a nominal impedance of 15 ohms (12—20 ohms). Provision is made, however, for connection to 4—8 ohm loudspeakers by removing the base plate of the power amplifiers and removing the link between tags R and S on the output transformer, and linking instead tags Q to R and S to T.

When the loudspeaker leads are reasonably short, thin flex may be used, but if longer runs are employed then the cable should be sufficiently thick for its resistance not to exceed 10% of the loudspeaker impedance.

The two combination cables from the control unit should now be plugged in to the power amplifiers, the cable coloured yellow being connected to the power amplifier feeding the "yellow" speaker and the cable coloured blue to the amplifier feeding the "blue" speaker. When one power amplifier only is used it must be connected to the yellow cable from the control unit, the blue cable being left unconnected.

## Pickup

The range of adaptor units provides separately for the stereo and monaural inputs, so that when two pickups are used they may be of entirely different types. If a single pickup is to be used for all records then the pickup adaptor unit must be of the type identified by a single letter. If separate pickups are to be used for stereo and monaural records then the adaptor unit must be of a type identified by two letters. The letters themselves relate to correct matching and should be chosen to suit the types of pickup used. A list showing the appropriate unit for various pickups is enclosed.

The yellow and blue inputs reproduce on the yellow and blue loudspeakers respectively. The black gram input is for the separate monaural input when this facility is required.

In the pickup connections, reference should be made to the pickup manufacturers' instructions. Stereo pickups fall into two categories; those with two entirely isolated outputs and those in which the two outputs have one connection common. The various methods of connection are shown in fig. 1.

Each control unit is supplied with a Pickup Adaptor. Should this be unsuitable for the pickups in use, or if it is required to use a stereo pickup for both stereo and

monaural discs, the Pickup Adaptor may be exchanged free of charge within the guarantee period of 12 months either through the dealer from whom the amplifier was purchased, or in the case of difficulty, through the main distributor for that country (in the U.K. the Acoustical Manufacturing Co. Ltd). A box in which to return the unit and a special double label are provided to facilitate exchange by post where necessary.

## Radio

Two radio inputs may be connected monaurally to Radio 1 (yellow) and Radio 2 (black). A stereo channel may be accommodated on Radio 1 by using inputs Radio 1 (yellow and blue). For stereo any of three arrangements is possible, depending upon the broadcast system in use. Connections for these are shown in fig. 2.

The HT supplies at the three sockets become alive only when the appropriate service is selected by the push buttons. The total currents which may be drawn are as follows :

L.T. 6.3 Volts Yellow & Black	3 Amps total
Blue	3 Amps

H.T. 330 Volts Yellow, Black	
& Blue	35mA each

The screen of the audio lead carries the H.T. negative return.

## Tape

Two inputs and two outputs are provided for connections to a tape machine. The yellow sockets are operative for monaural requirements and the yellow and blue sockets for stereo.

When connecting a recorder which includes its own record and replay amplifiers, the "Tape N" adaptor should be used. The equalised replay output(s) of the recorder should be fed into the TAPE socket(s) and the maximum signal level should lie between 0.1 and 0.5 volts. A load of 100,000 ohms is imposed across the recorder output.

The TO sockets (for recording) provide a peak level of approximately 0.25 Volt unaffected by bass, treble and filter controls. The input resistance of the tape recorder should not be less than 500,000 ohms and the capacity including the coupling cable should not exceed 200pF.

If tape replay is required direct from the replay head a "Tape H1" (for European tapes) or "Tape H2" (for American tapes) adaptor should be used. For high impedance heads connection is made direct to the TAPE socket(s). For low impedance heads connection is made via the head manufacturer's coupling transformer to the TAPE socket(s), the lead between the transformer and the sockets being kept as short as possible.

## Microphone

A microphone may be connected to the MIC input (black), this input being monaural only. The sensitivity is 1.5 mV rms at 100,000 ohms. Facilities for stereo microphones may be obtained by replacing the "Tape N" adaptor by a "MIC N" adaptor and feeding a twin microphone to the "TAPE" inputs (yellow and blue). Sensitivity is 1.5 mV rms at 100,000 ohms.

## Mains Connections

An efficient connection to earth should be provided and this should be connected to the "E" terminal on the back of the control unit.

Before connecting the mains, ensure that the voltage adjusting screws in the power amplifiers are correctly set to the voltage of the mains supply. AC mains may now be connected to the rear of the control unit by means of the 2 pin socket provided.

## Installation Adjustments

All the services required should now become available by pressing the appropriate buttons.

If it was not possible to phase the loudspeakers correctly during installation (see page three) this should now be carried out. A programme should be reproduced using the 2 MON service and the balance control adjusted to give approximately equal volume from the two loudspeakers. Listening at an equal distance from the two loudspeakers, the sound should appear to emanate from a point midway between them. If this is indefinite, the connections to one of the loudspeakers (either) should be reversed. The correct connection is that which gives a definite centre sound source and this will also be accompanied by a fuller sound in the tenor and bass registers. The effect may be exaggerated and the test therefore made easier if the loudspeakers are placed closer together.

The next adjustment is that of balance. This should be carried out in two stages :—

- (a) Select the two buttons marked Stereo and Disc. Play a monaural record with the stereo pickup and adjust the balance control until the sound appears midway between the loudspeakers. Note the setting required.
- (b) If a multiplex radio and stereo tape machine are installed, they should now be similarly balanced using their own pre-set controls and leaving the

QUAD 22 balance control as already set under (a) above.

The balance control will now operate on all programmes but should require no attention for day to day listening. The only exceptions to this are :

- (1) If FM/AM stereo is used, or
- (2) If a misbalanced (and therefore faulty) record is to be played.

The balance control may require adjustment if the loudspeaker position or the environment is changed.

### Loudspeaker Position

The standard of reproduction obtained from any loudspeaker is influenced by both its position in the room and its position in relation to the listening area. The optimum position can only be found by experiment and this cannot be carried out quickly or in a perfunctory manner, if long term non-fatiguing listening is to be obtained.

With the advent of an additional speaker for stereo the difficulties are enormously increased. It is a fact that the standard of reproduction in many homes, both single channel and stereo, is significantly below that which could be obtained if sufficient attention had been paid to loudspeaker positioning.

It has been broadly stated that for stereo the two loudspeakers should be 6ft. to 8ft. apart with the listener at a similar distance from each.

Clearly, when more than one person is listening they cannot both occupy the same position and all listening tests should aim at obtaining good stereo over a reasonable area.

This can usually be achieved over an area immediately behind the listening point already defined, with a width equal to the distance between speakers and with a similar depth.

Outside this area the overall quality should be satisfactory although the perspective may be degraded.

The measurement of 6ft. — 8 ft. is based on a small room. With a larger room the scale may be increased accordingly.

The quality of the results obtained will depend upon the following :

single channel :—

- (a) The position of the loudspeakers with respect to the room boundaries (and sometimes floor joists).
- (b) The direction of loudspeaker axis.
- (c) The position of large pieces of furniture.

With stereo the following may be added :—

- (d) The distance apart.
- (e) The point of intersection of the loudspeaker axes
- (f) The relation of the base line (an imaginary straight line joining the two speakers) to the room boundaries.
- (g) The position of the listeners.

This list is formidable. The instructions supplied with the loudspeaker may resolve some of the variables, the rest must be solved by experiment. Few people can successfully complete these experiments at a single session and it is strongly recommended that the following procedure be adopted.

The single channel loudspeaker should be tried in the various room positions which appear physically possible, in order to ascertain which positions are likely to be worth further investigation.

The loudspeaker should now be used in each of these positions for normal day to day listening. Normal attention should be given to the programme itself *with no conscious concentration on the quality*. In this way the optimum position for most satisfactory listening will become apparent.

A similar approach should be applied to stereo with the object of arriving at a position for the two speakers which is compatible with all listening requirements.

## OPERATION

Once the equipment has been properly installed, operation becomes simple and straightforward.

The equipment is switched on by rotating the volume control clockwise from the OFF position. The QUAD insert should now be illuminated.

The programme and the type of service required should now be selected by means of the push buttons.

The input required is selected by depressing one or a combination of the four right-hand buttons. The service required—i.e., stereo, single channel on one loudspeaker or single channel on two loudspeakers—is selected by means of the remaining two buttons on the left-hand side.

With the stereo button depressed, choice of three stereo inputs becomes available selected by the appropriate button—Radio—Tape—Gram.

With the MON (monaural) button depressed, the following single channel inputs become available—Radio 1 — Radio 2 — Tape — Microphone—Gramophone. In addition there is a choice of four playback characteristics for gramophone, obtained by pressing a combination of buttons in accordance with the chart enclosed in

this booklet. By depressing both left-hand buttons, all the monaural facilities are available as already described but reproduced now on both loudspeakers through both power amplifiers. When two adjacent buttons have to be pressed it will be found more convenient to use one finger only, applying pressure over the gap between the buttons.

The filter should initially be set to the 7K position with the filter slope and the bass and treble controls at "level."

Musical balance of treble and bass is adjusted by the treble and bass controls. With a high grade loudspeaker only very slight deviation from level should ever be required.

Small deviations of the bass control will affect very low notes only. Greater deviations affect not only the very low notes to a greater extent but also the higher bass notes. The treble control affects brilliance.

The filters affect the extreme harmonic range only and do not interfere with musical brilliance. Their purpose is to enable the maximum content of the programme to be reproduced with the minimum distortion.

With most types of recording the distortion inherent in the recording system itself is greatest at very high frequencies. The wider the loudspeaker range the more audible this is liable to become. It may be removed or mitigated by rotating the filter slope control anti-clockwise from the level position. As the control is rotated, the quality and "cleanliness" of the reproduction will improve. There will, however, be a point at which further rotation degrades the sound due to intrusion into the useful harmonic range.

The 7K is the most useful switch position for modern recordings. The 5K switch position transposes the filter operation to a lower frequency for use with older recordings. Conversely the 10K position transposes the filter to higher frequencies and here it is useful on high quality transmissions where it may be used for the subtle correction of imperfections associated with microphones.

A cancel position is fitted to the filter switch. In this position, the bass, treble and filters are all bypassed to give a level response. This position is a reference by which the effects of the settings of the other controls may be judged without upsetting the position of these controls.

The control situated immediately beneath the volume

control adjusts the relative volume from the two loudspeakers. It should require no attention during normal operation, but see page six.

The whole of the operation of the equipment may be summarised :

Use bass and treble controls to give best results on all types of programme. This helps compensate for loudspeaker peculiarities, personal preference, etc.

Select programme and type of service.

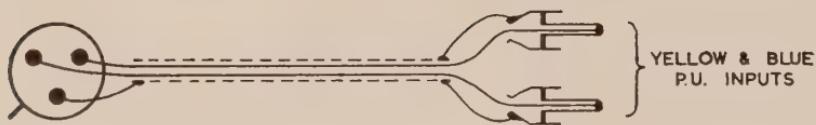
Adjust volume to suitable level.

Adjust filter as required. (7K switch position may be regarded as normal).

Alter bass and treble only if it is required to alter the musical balance.

With a magnetic tape recorder properly connected to the unit, it is possible to record any programme selected by the control unit push buttons. The correct level must be set at the tape machine. The recording will then be correctly carried out independently of the setting of the QUAD 22 controls. These may therefore be adjusted as desired to suit listening conditions while the recording is in progress.

STEREO P.U. WITH COMMON CONNECTION



MONAURAL P.U. IF REQUIRED SEPARATELY



STEREO P.U. WITH ISOLATED OUTPUTS

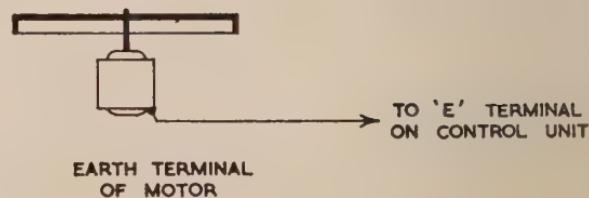
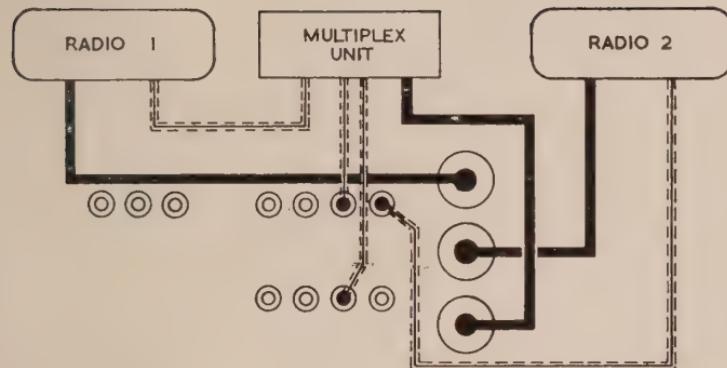


FIG. 1

## RADIO CONNECTIONS

(A) MULTIPLEX



(B) SEPARATE CHANNELS

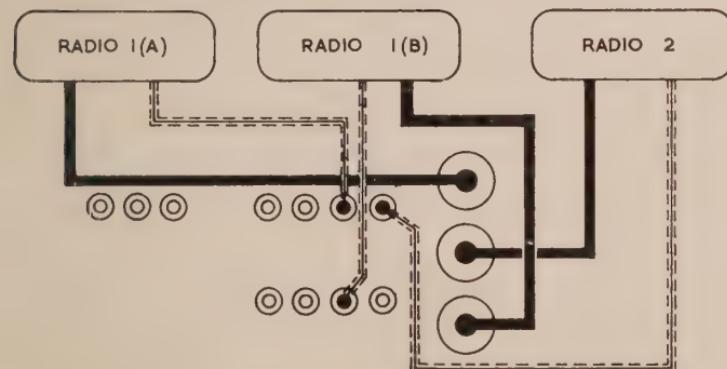
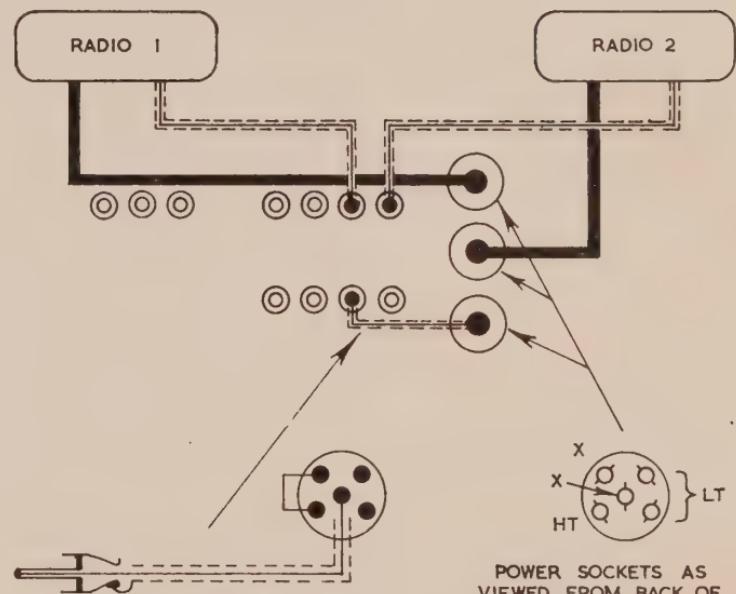


FIG. 2

(C) RADIO 2 TO PAIR WITH RADIO 1



POWER SOCKETS AS  
VIEWED FROM BACK OF  
CONTROL UNIT.  
X — INTERNAL CONNECTION

# Guarantee

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*This instrument is guaranteed against any defect in material or workmanship for a period of twelve calendar months from the date of purchase.*

*Within this period we undertake to supply replacements free of charge for any parts excepting valves (which are covered by the makers' guarantee of three months) which may prove on examination to be defective, provided that such defectiveness is not the result of misuse (including use with unsuitable ancillary equipment), accident or negligence, and further that the instrument was purchased at the proper consumer price prevailing in the country of purchase.*

*Any set requiring service under this guarantee should be taken to the supplier through whom it was purchased, or, in case of difficulty, it should be carefully packed and consigned, carriage paid, to the main distributor for the country of purchase. It must not be sent to any other agent or distributor except by special arrangement.*

*This guarantee is valid only when the enclosed card is properly filled in and returned for registration as directed within ten days of purchase, and does not cover labour or carriage costs involved in any repair under the guarantee.*

ACOUSTICAL MFG. CO. LTD.,

HUNTINGDON, ENGLAND.

# **QUAD 22 CONTROL UNIT**

# **QUAD II POWER AMPLIFIER**

## **MAINTENANCE**

**It is important that similar components are used for replacement purposes, especially as to tolerance, rating, and, in the case of condensers, construction.**

## QUAD 22 CONTROL UNIT COMPONENTS LIST

Component Reference	Value	Tolerance	Makers Reference	Stock No.	Layout Photograph
R.1	100K	± 10%	Dubilier BTS	200/A	A
R.2	100K	± 10%	Dubilier BTS	200/A	B
R.3	100K	± 10%	Dubilier BTS	200/A	A
R.4	4.7K	± 10%	Dubilier BTS	240/F	A
R.5	47K	± 10%	Dubilier BTS	208/F	A
R.6	15K	± 10%	Dubilier BTS	224/C	A
R.7	10K	± 10%	Dubilier BTS	230/E	A
R.8	100K	± 10%	Dubilier BTS	200/A	A
R.9	82K	± 10%	Dubilier BTS	203/B	A
R.10	4.7K	± 10%	Dubilier BTS	240/F	C
R.11	100K	± 10%	Dubilier BTS	200/A	C
R.12	1.5M	± 10%	Dubilier BTS	160/A	A
R.13	1.5M	± 10%	Dubilier BTS	160/A	A
R.14	2.7K	± 10%	Dubilier BTS	248/D	A
R.15	2.7K	± 10%	Dubilier BTS	248/D	A
R.16	270K	± 5%	Painton 73	185/C	A
R.17	270K	± 5%	Painton 73	185/C	A
R.18	1.5M	± 10%	Dubilier BTS	160/A	A
R.19	1.5M	± 10%	Dubilier BTS	160/A	A
R.20	47K	± 10%	Dubilier BTS	208/F	A
R.21	4.7K	± 5%	Painton 72	240/G	A
R.22	4.7K	± 5%	Painton 72	240/G	A

Component Reference	Value	Tolerance	Makers Reference	Stock No.	Layout Photograph
R.23	470K	± 5%	Painton 73	176/F	A
R.24	470K	± 5%	Painton 73	176/F	A
R.25	27K	± 10%	Dubilier BTS	210/D	A
R.26	1.5M	± 10%	Dubilier BTS	160/A	A
R.27	1.5M	± 10%	Dubilier BTS	160/A	A
R.28	1K	± 10%	Dubilier BTS	258/E	A
R.29	1K	± 10%	Dubilier BTS	258/E	A
R.30	47K	± 10%	Dubilier BTS	208/F	A
R.31	47K	± 10%	Dubilier BTS	208/F	A
R.32	15K	± 10%	Dubilier BTS	224/C	A
R.33	39K	± 10%	Dubilier BTS	208/M	B
R.34	68K	± 10%	Dubilier BTS	205/B	B
R.35	39K	± 10%	Dubilier BTS	208/M	B
R.36	68K	± 10%	Dubilier BTS	205/B	B
R.37	12K	± 10%	Dubilier BTS	228/D	B
R.38	12K	± 10%	Dubilier BTS	228/D	B
R.39	330K	± 10%	Dubilier BTS	179/B	B
R.40	330K	± 10%	Dubilier BTS	179/B	B
R.41	27K	± 10%	Dubilier BTS	210/D	B
R.42	68K	± 10%	Dubilier BTS	205/B	B
R.43	27K	± 10%	Dubilier BTS	210/D	B
R.44	68K	± 10%	Dubilier BTS	205/B	B
R.45	220	—	Dubilier SFK38R with R46 C32 and C33	441/C	C
R.46	220	—	See R45		C
R.V.1A.	500K Log		Acoustical Drg. No. A 11350 Iss. 2 with RV1B, RV3 and S4A-B	415/B	A
R.V.1B.	500K Log		Ganged and Matched with RV1A		A

Component Reference	Value	Tolerance	Makers Reference	Stock No.	Layout Photograph
R.V.2A.	500K Lin		Acoustical Drg. No. A11351 Iss. 1 with RV2B Ganged and Matched with RV2A	410/J	B
R.V.2B.	500K Lin		With RV1A		B
R.V.3	12.5K				A
R.V.4A.	250K Log		Acoustical Drg. No. A11351 Iss. 1 with RV4B	405/A	B
R.V.4B.	250K Log		Ganged and Matched with RV4A		B
R.V.5A.	100K Lin		Acoustical Drg. No. A11351 Iss. 1 with RV5B	400/E	B
R.V.5B.	100K Lin		Ganged and Matched with RV5A		B
C.1	5000p	± 10%	Dubilier 400	510/C	C
C.2	5000p	± 10%	Dubilier 400	510/C	A
C.3	.1μ	—	Hunts AM 108	495/A	A
C.4	.1μ	—	Hunts AM 108	495/A	A
C.5	25μ	—	Hunts MEW7T	465/E	A
C.6	25μ	—	Hunts MEW7T	465/E	A
C.7	16μ	—	Hunts KDN485 with C12 and C15	469/C	A
C.8	.5μ	—	Hunts A302	490/E	A
C.9	.5μ	—	Hunts A302	490/E	A
C.10	25μ	—	Hunts MEW7T	465/E	A
C.11	25μ	—	Hunts MEW7T	465/E	A
C.12	16μ	—	See C7	—	A
C.13	820p	± 10%	Suflex HS15/L	519/A	A
C.14	820p	± 10%	Suflex HS15/L	519/A	A
C.15	16μ	—	See C7	—	A
C.16	.1μ	—	Hunts AM108	495/A	C
C.17	.1μ	—	Hunts AM108	495/A	C
C.18	5000p	± 10%	Dubilier 400	509/A	B
C.19	5000p	± 10%	Dubilier 400	509/A	B
C.20	5000p	± 10%	Dubilier 400	509/A	B

Component Reference	Value	Tolerance	Makers Reference	Stock No.	Layout Photograph
C.21	5600p	± 10%	Dubilier 400	509/A	B
C.22	4000p	± 10%	Dubilier 400	513/C	B
C.23	4000p	± 10%	Dubilier 400	513/C	B
C.24	220p	± 10%	Suflex HS12L	526/A	B
C.25	220p	± 10%	Suflex HS12L	526/A	B
C.26	220p	± 10%	Suflex HS12L	526/A	B
C.27	220p	± 10%	Suflex HS12L	526/A	B
C.28	4000p	± 10%	Dubilier 400	513/C	B
C.29	4000p	± 10%	Dubilier 400	513/C	B
C.30	1500p	± 20%	Dubilier 400	515/N	B
C.31	1500p	± 20%	Dubilier 400	515/N	B
C.32	.05μ	—	See R45	—	C
C.33	.05μ	—	See R45	—	C
C.34	.02μ	—	Hunts B807	505/A	A
C.35	.02μ	—	Hunts B807	505/A	A
L.1			Acoustical Spec. No. 1023	—	B
L.2			Acoustical Spec. No. 1023	—	B
V.1			Mullard EF86	—	A and B
V.2			Mullard EF86	—	A and B
V.3			Mullard ECC83	—	A and B
V.4			Mullard ECC83	—	A and B
I.P.1			Osram Type OS76 6.3v .115A 11mm MES Round	690/J	C

## QUAD II POWER AMPLIFIER COMPONENTS LIST

Circuit No.	Value	Tolerance	Makers Ref.	Stock No.	Layout Photograph
R.1	1.5M	± 10%	Erie 9	160C	D
R.2	1.M	± 10%	Erie 8	165B	D
R.3	1.M	± 10%	Erie 8	165B	D
R.4	680	± 10%	Erie 8	261B	D
R.5	180K	± 5%	Erie 8	190D	D
R.6	180K	± 5%	Erie 8	190D	D
R.7	680K	± 10%	Erie 8	170C	D
R.8	2.7K	± 10%	Erie 8	248C	D
R.9	680K	± 10%	Erie 8	170C	D
R.10	100	± 5%	Erie 109	305E	D
R.11	470	± 5%	Erie 109	270D	D
R.12	180	± 5%	Dubilier A1/1	290A	D
C.1	.1mF	± 20%	Hunts A300	495D	D
C.2	.1mF	± 20%	Hunts B406P	495B	D
C.3	.1mF	± 20%	Hunts B406P	495B	D
C.4	16mF	— 20% + 50%	TCC (Etched Foil Section with C6)	469A	D
C.5	25mF	— 20% + 100%	Hunts MEW29	465B	D
C.6	16mF	— 20% + 50%	TCC (Plain Foil Section with C4)	469A	D

Circuit No.	Value	Tolerance	Makers Ref.	Stock No.	Layout Photograph
V.1			Mullard EF86		D
V.2			Mullard EF86		D
V.3			G.E.C. KT66		D
V.4			G.E.C. KT66		D
V.5			Mullard GZ32		D
T.1			Output Transformer Spec. No. 1003A		D
T.2	200 - 250V		Mains Transformer Spec. No. 1001		D
T.2	95 - 125V		Mains Transformer Spec. No. 1008		D
L.1			Choke Spec. No. 1002		D
F.S.1	200 - 250V		2A $1\frac{1}{4}$ x $\frac{1}{4}$ Belling Lee L1055	675E	D
F.S.1	95 - 125V		3A $1\frac{1}{4}$ x $\frac{1}{4}$ Belling Lee L1055	675D	D

## QUAD 22 CONTROL UNIT SPECIFICATION

### FREQUENCY RESPONSE

Cancel position:

Radio and Tape inputs: 20-20,000 c/s  $\pm$  0.5 dB.

Microphone: 20-20,000 c/s  $\pm$  2 dB.

Gramophone: Maintained over 20-20,000 c/s  
within  $\pm$  1 dB of the following characteristics:

		3180 $\mu$ S	318 $\mu$ S	75 $\mu$ S
		3180 $\mu$ S	318 $\mu$ S	100 $\mu$ S
		3180 $\mu$ S	450 $\mu$ S	50 $\mu$ S
		— $\mu$ S	450 $\mu$ S	25 $\mu$ S

Bass and treble controls:  $\pm$  1.5 dB of published curves.

Filter frequencies: 5 Kc/s, 7 Kc/s, 10 Kc/s.

Filter slope: See curves.

### INPUT SENSITIVITY (at 1 Kc/s for 1.4 Vrms output)

Radio: 70 mVrms, load impedance 100,000 ohms.

Tape: Depending upon adaptor unit.

Microphone: 1.5 mVrms, load impedance 100,000 ohms.

Pick-up: Depending upon adaptor unit. Basic sensitivity prior to compensation 400  $\mu$ Vrms.

### DISTORTION (1.4 Vrms output):

All controls level: Any input: 0.02%.

Least favourable arrangement of controls: less than 0.1%.

### NOISE

Total hum and noise: Better than —70 dB.

Noise: —80 dB or where applicable, the equivalent noise of the pick-up load impedance at the input.

### OUTPUT

Control unit to power amplifier: 1.4 Vrms.

Tape outputs: Maximum signal approx. 0.25 Vrms.

Maximum loading 500,000 ohms and 200 pF.

### INTERCHANNEL SPECIFICATION

Cross talk: Better than 40 dB 20-20,000 c/s.

Gain stability: With any volume setting and tone controls

level: Less than 1 dB between channels.

With any volume setting and tone controls

varied: Less than 2dB between channels.

Balance control: Provides up to 9 dB unbalance either way.

### POWER SUPPLY

The unit takes its power from the power amplifier as follows:—

330 V 4mA. } Plus current taken by tuner units.

6.3 V 1.1 A. }

Maximum power available from tuner sockets:

330 V 35 mA each tuner.

Rad. 1 and Rad. 2: 6.3 V 3 A total.

Rad. 1 (2nd channel): 6.3 V 3 A.

The heater supply is C.T. to chassis

### VALVES

2 x EF86 (Z.729 or 6267).

2 x ECC83 (12AX7).

## **QUAD II POWER AMPLIFIER SPECIFICATION**

*Figures for response, distortion, sensitivity and background are the pass figures on final test*

### **POWER OUTPUT**

15 watts throughout the range 20-20,000 c/s.

### **FREQUENCY RESPONSE**

Within 0.2 dB 20-20,000 c/s.  
Within 0.5 dB 10-50,000 c/s.

### **DISTORTION** (measured at 12 watts output).

Total 3rd and higher order: less than 0.1% at 700 c/s.  
Higher order alone: less than 0.03% at 700 c/s.  
Valve mismatching up to 25% (introducing 2nd harmonic) not  
to cause distortion to exceed 0.18%. Total distortion at 50 c/s  
not to exceed 0.25%.

### **INPUT**

Sensitivity: 1.4 Vrms for 15 watts output.  
Load imposed on input: 1.5 Megohms in parallel with 10 pF.

### **BACKGROUND**

80 dB referred to 15 watts.

### **OUTPUT IMPEDANCES** 15 ohm and 7 ohm.

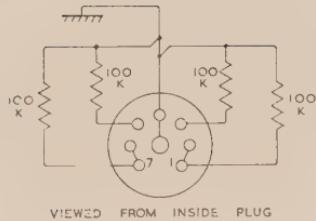
Effective output resistance: 1.5 ohm for 15 ohm output.

### **POWER SUPPLIES**

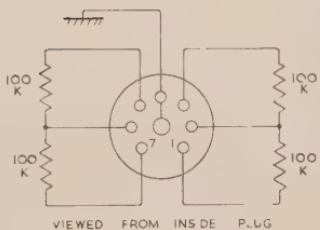
INPUT: 200-250 V. AC single phase (or 95-125 V. AC)  
40-80 c/s.  
90 watts consumption (excluding control unit,  
tuners, etc.)

HT AND LT supplies available for external equipment:  
330 V. 40 mA.  
6.3 V. 4 A. (heater C.T. to chassis).

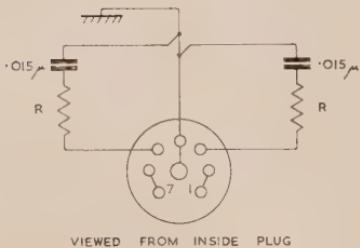
**VALVES** 2 x EF.86 (Z.729 or 6267), 2 x KT.66 (5883 or  
6L6G matched), 1 x GZ.32 (54KU. or 5V4G).



MIC N



TAPE N



TAPE H

### TAPE INPUT ADAPTOR UNITS

Adaptor Type	Tape Input Sensitivity at 1,000 c/s	Load resistance presented by amplifier	Response
MIC N	1.5 mV	100,000 ohms	Level
TAPE N	70 mV	100,000 ohms	Level
TAPE H1	6 mV	1.5 megohms	100 μSec CCIR 7½"/Sec replay characteristic.
TAPE H2	7 mV	1.5 megohms	50 μSec NAB 7½" and 15"/Sec replay characteristic.
TAPE H3	7 mV	1.5 megohms	35 μSec CCIR 15"/Sec replay characteristic.

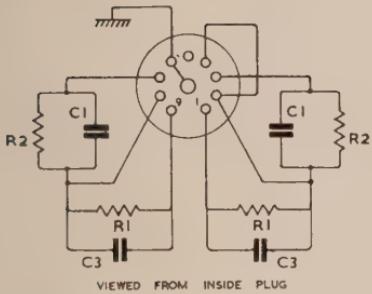
### Component Values for Tape H Adaptors

TAPE H1 R = 6,800 ohms

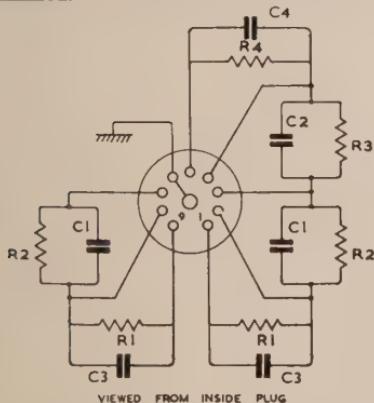
TAPE H2 R = 3,300 ohms

TAPE H3 R = 2,200 ohms

## Component List for Pickup Adaptor Units



### SINGLE LETTER ADAPTOR



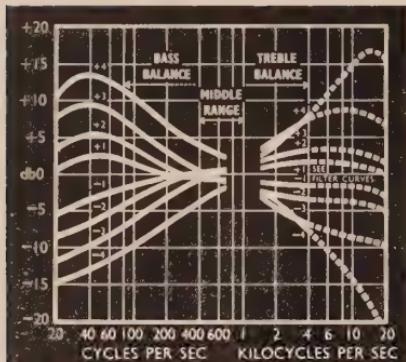
### DOUBLE LETTER ADAPTOR

	R1	R2	R3	R4	C1	C2	C3	C4
A	68K	—	—	—	180p	—	—	—
AA	68K	—	—	68K	180p	180p	—	—
AB	68K	—	10M	68K	180p	560p	—	—
AE	68K	—	330K	1.5M	180p	1000p	—	47p
B	68K	10M	—	—	560p	—	—	—
BA	68K	10M	—	68K	560p	180p	—	—
BB	68K	10M	10M	68K	560p	560p	—	—
BE	68K	10M	330K	1.5M	560p	1000p	—	47p
E	1.5M	330K	—	—	1000p	—	47p	—
E\	1.5M	330K	—	68K	1000p	180p	47p	—
EB	1.5M	330K	10M	68K	1000p	560p	47p	—
EE	1.5M	330K	330K	1.5M	1000p	1000p	47p	47p

Adaptor type	Pickup input sensitivity at 1,000 c/s	Load resistance presented by amplifier
A	4 mV	68,000 ohms
B	10 mV	68,000 ohms
E	300 mV	1.5 Megohms

*Note:* This information applies to either stereo or monaural channels according to whether the first or second letter of the type is considered.

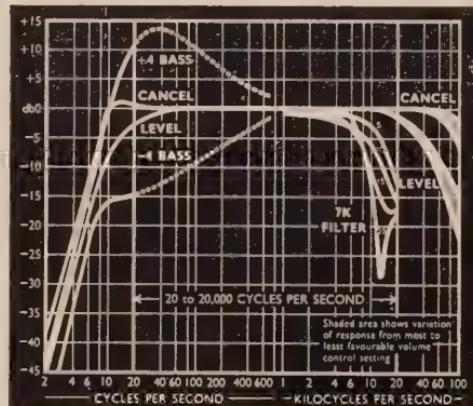
## QUAD 22 CONTROL UNIT



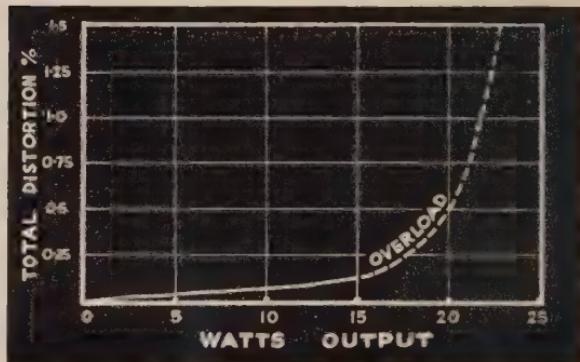
Curves showing extended frequency response and effect of the 7K filters.

A multi-element high-pass filter rapidly attenuates the sub-audio frequencies without encroachment into the useful range making a switchable roll-off superfluous.

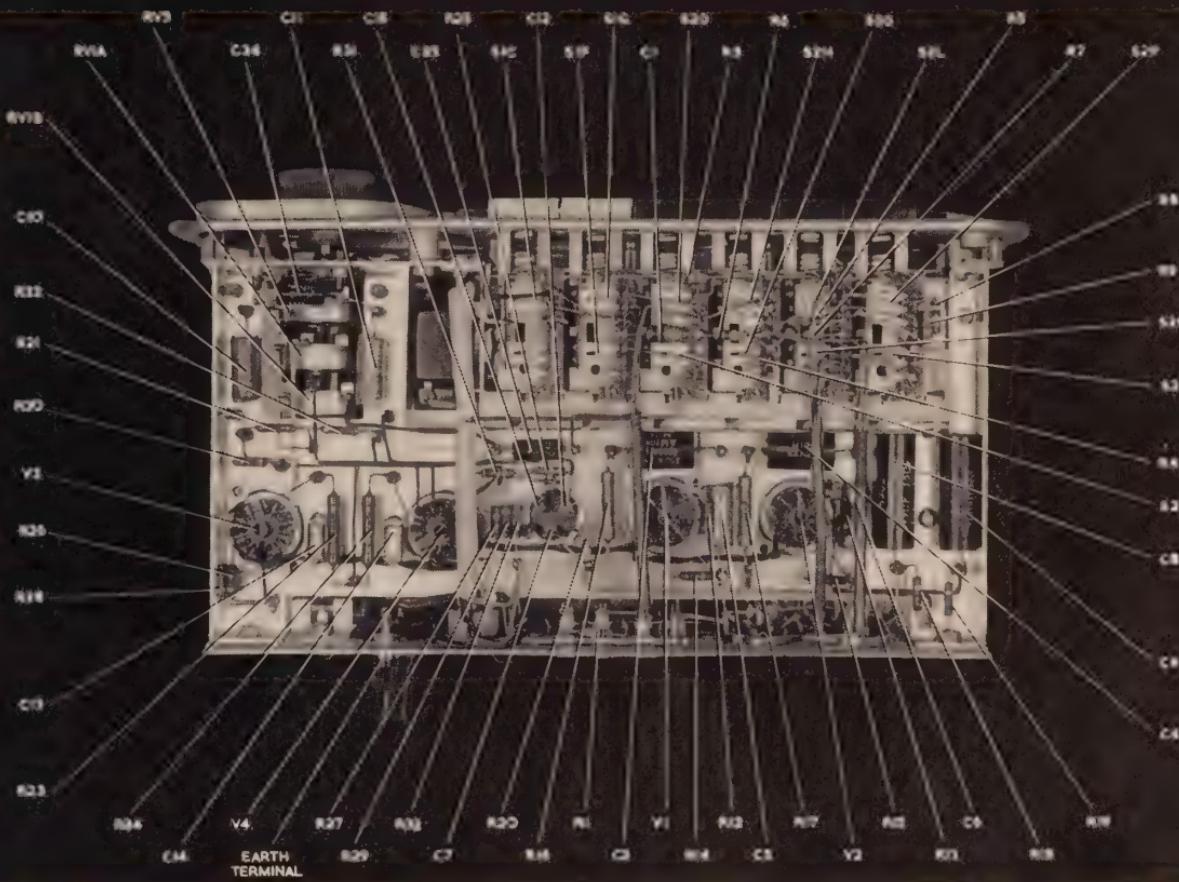
The filter curves shapes are accurately maintained and the figures adjacent to the curves are the approximate dial settings. The 5K and 10K filters provide similar curves one half octave up or down.



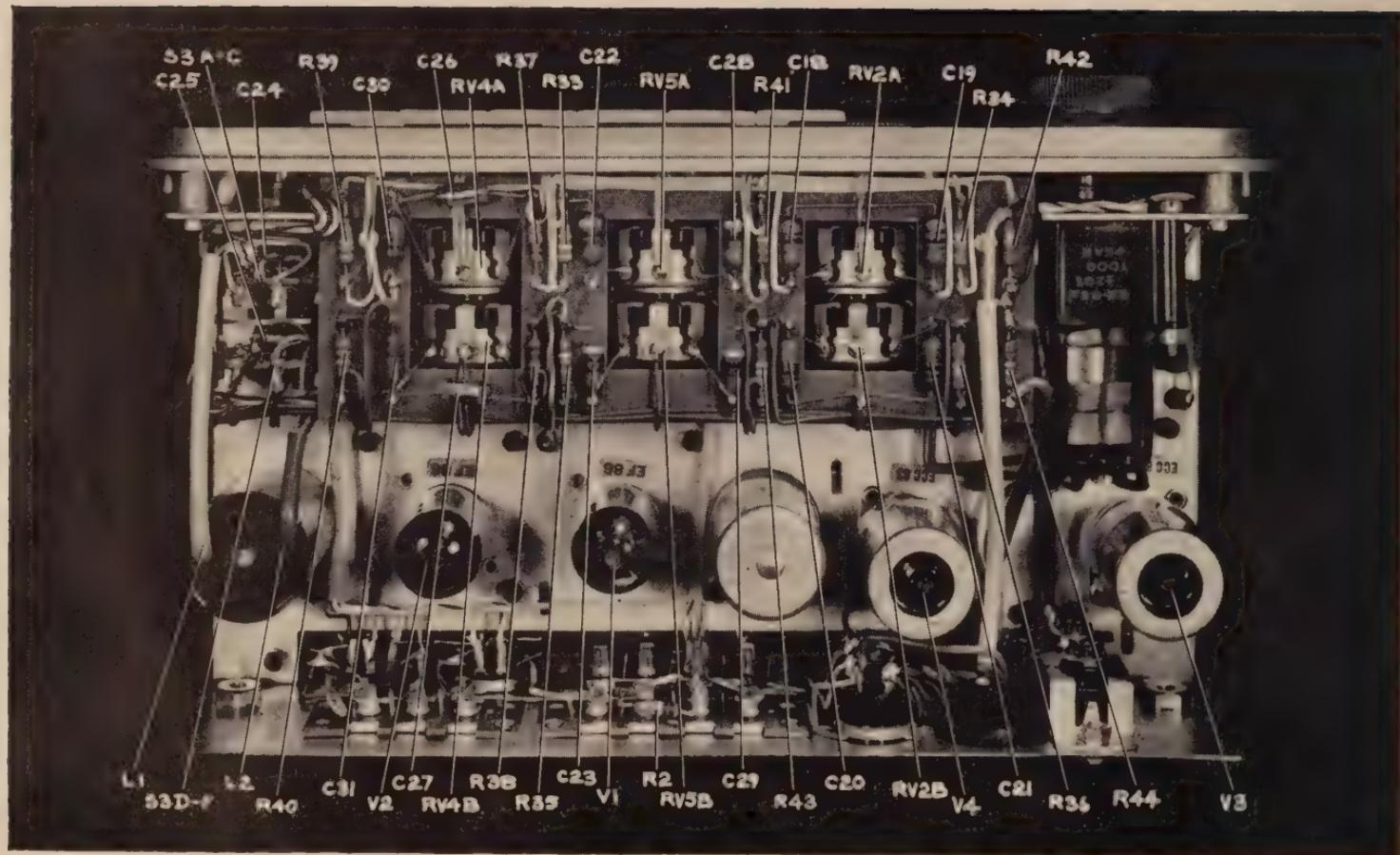
## QUAD II POWER AMPLIFIER

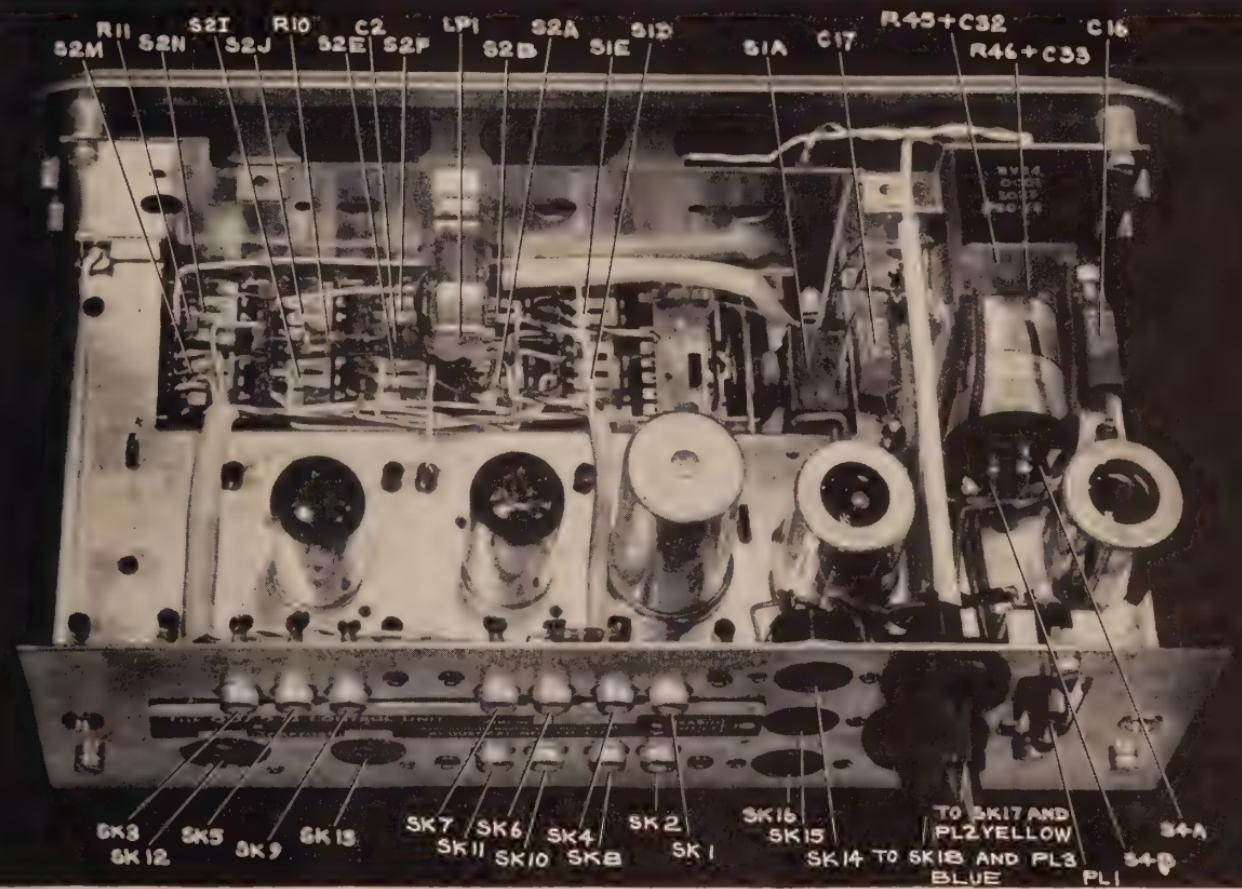


Linearity and overload of the QUAD II power amplifier

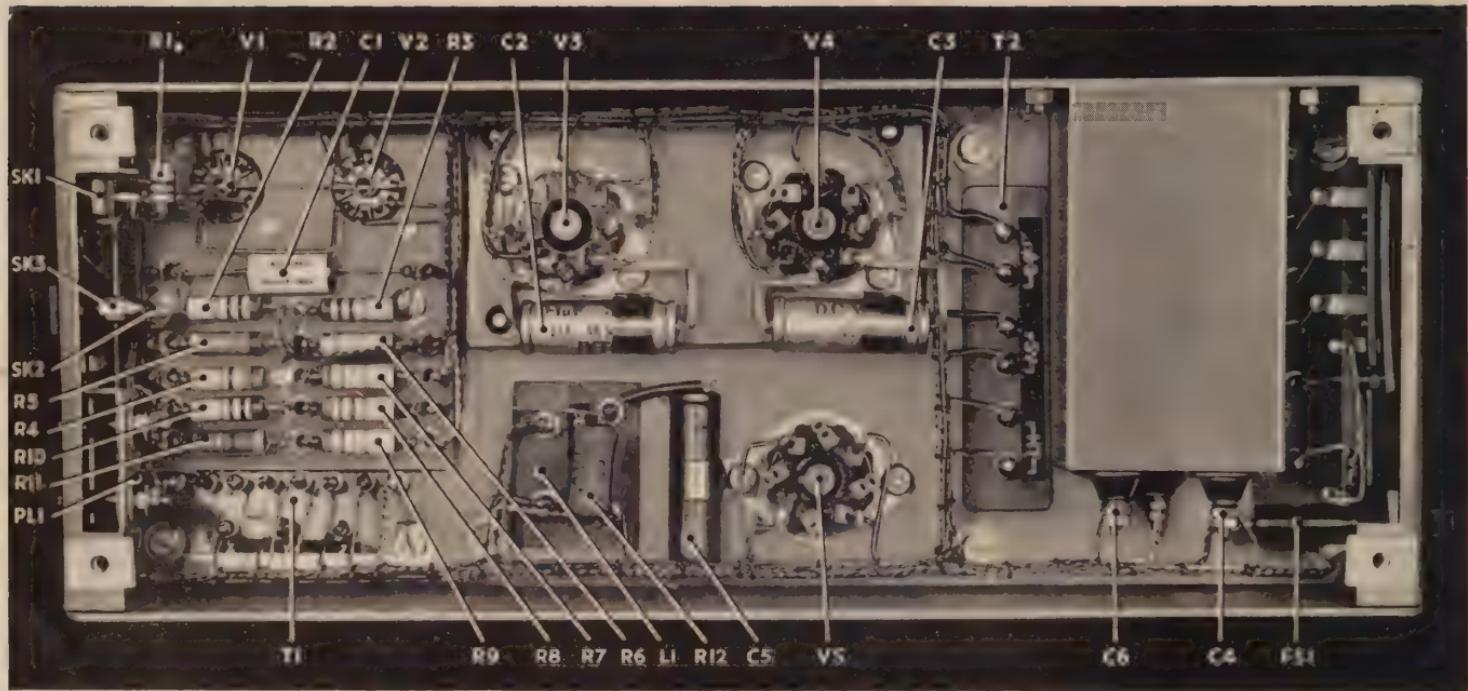


LAYOUT PHOTOGRAPH A





LAYOUT PHOTOGRAPH C

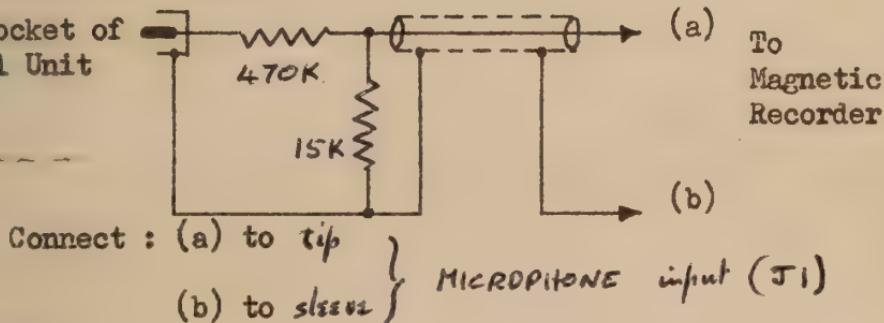


## Magnetic Recorder Connexions to QUAD Control Units

Make - - - A K A I - - - Type - - - M - 6 - - -

### Record Connexion

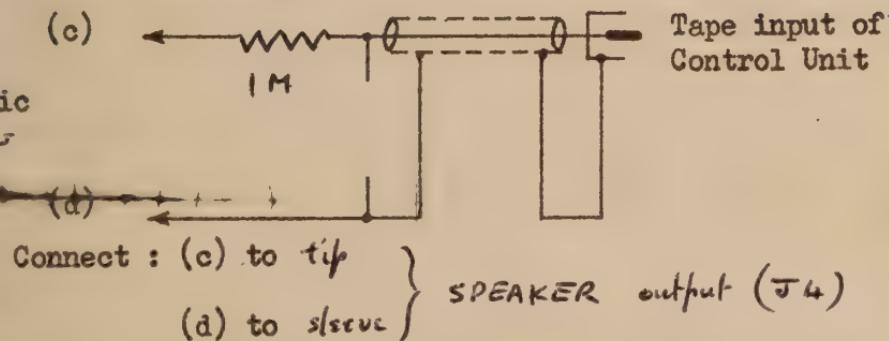
T.O. Socket of  
Control Unit



### TO ~ PHONO

### Replay Connexion

From  
Magnetic  
Recorder



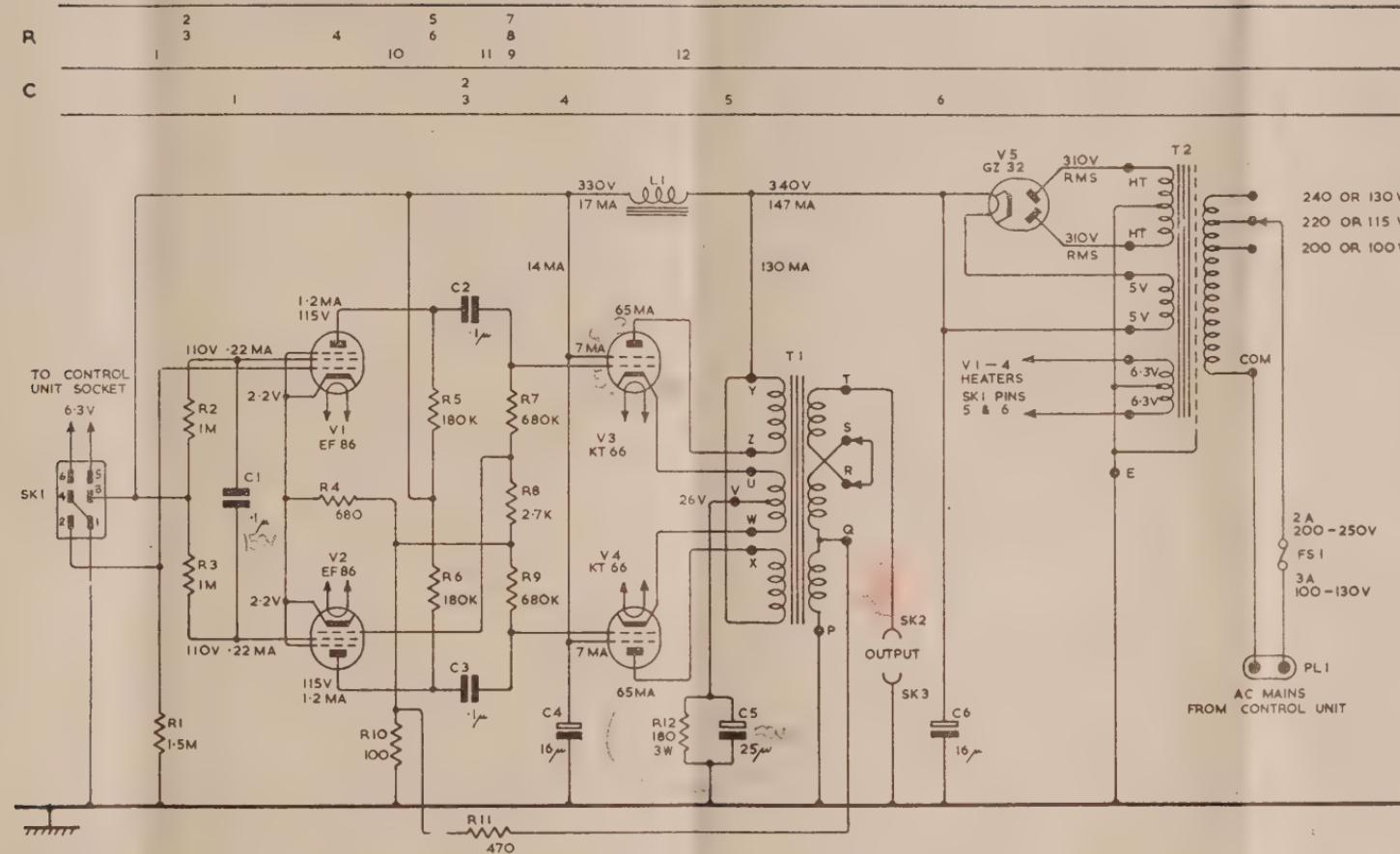
### NOTE :-

The above recommendation is based on data available but has not been proved in practice by our laboratory.

The connexion between the screened cable and its terminations should be kept as short as possible.



QUAD II POWER AMPLIFIER



British American

G2-32  
SV4

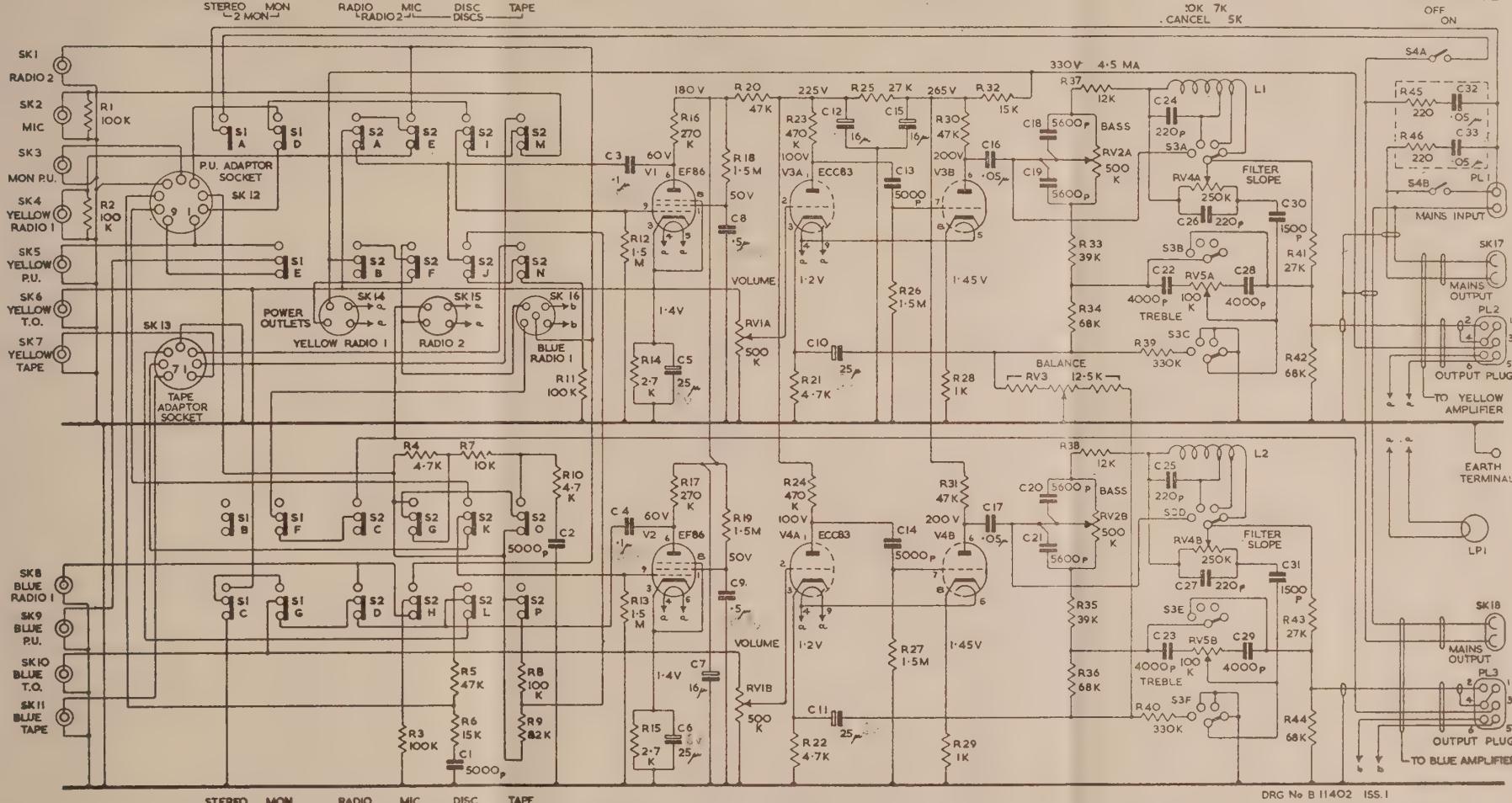
KT66  
GL6GC

EF86  
G267

AC MAINS  
FROM CONTROL UNIT



**C** 2 4 5 6 8 10 12 13 15 16 17 18 19 20 22 25 26 28 30 32 33 34  
1 6 7 9 11 13 14 21 23 27 29 31 33 34



THE VOLTAGE AND CURRENT MEASUREMENTS SHewn ARE APPROXIMATE, AND ARE ONLY PROVIDED AS A GUIDE. ALLOWANCE SHOULD BE MADE FOR THE LOADING EFFECTS OF A VOLTMETER.

QUAD 22 CONTROL UNIT  
CIRCUIT DIAGRAM



# QUAD 22 CONTROL UNIT

This pack contains the following accessories. Please check these items before disposing of the packing.

- 1 Instruction Book
- 1 Mounting Template
- 1 Record Equalisation Guide
- 1 Pickup Adaptor Unit List
- 1 Circuit Diagram Quad 22 control unit
- 1 " " Quad II power amplifier
- 1 Adaptor Unit Exchange Label
- 1 Pickup Adaptor Unit
- 1 Tape " "
- 1 Socket Ref. 671/C (Mains).
- 11 Plugs " 670/V (Signal inputs).
- 2 Plugs 4 pin " 670/W (Tuner power supplies).
- 1 Plug 5 pin " 670/T ( " " " )
- 3 Shells " 670/X ( " " " )

**CAUTION.—**This equipment must be connected to an efficient earth, either direct or via associated equipment (see Installation Instructions).

## Guarantee

This instrument is guaranteed against any defect in material or workmanship for a period of twelve calendar months from the date of purchase.

Within this period we undertake to supply replacements free of charge for any parts excepting valves (which are covered by makers' guarantee of three months) which may prove on examination to be defective provided that such defectiveness is not the result of misuse (including use with unsuitable ancillary equipment), accident or negligence, and further that the instrument was purchased at the proper retail price prevailing in the country of purchase.

Any set requiring service under this guarantee should be taken to the supplier through whom it was purchased, or, in case of difficulty, it should be carefully packed and consigned, carriage paid to the main distributor for the country of purchase quoting the date of purchase. It must not be sent to any other agent or distributor except by special arrangement.

This guarantee is valid only when the attached card is properly filled in and returned for registration as directed within ten days of purchase, and does not cover labour or carriage costs involved in any repair under the guarantee.

**ACOUSTICAL MANUFACTURING CO., LTD.**

Date of purchase 1.10.1963.....

Huntingdon, England.

*Tear off here*

# INSTRUCTIONS

Where a single stereo pickup with or without interchangeable heads is used to play both stereo and monaural discs the appropriate Pickup Adaptor is identified by a single letter. Table 1 shows the recommended Pickup Adaptor to be used with various types of stereo pickup.

If a separate pickup is used to play monaural discs (the stereo pickup then being used to play stereo records only), the Pickup Adaptor is identified by two letters. The FIRST letter is determined by the stereo pickup and is obtained from Table 1. The SECOND letter is obtained from Table 2 which shows the recommendation for types of monaural pickup. If a monaural pickup only is to be used, a two-letter adaptor is still required (see columns under Table 2).

Exceptions occur, usually where there is an appreciable difference in output between stereo and mono heads used in one arm, and special arrangements may be necessary in such cases, but generally with a two-letter adaptor the first letter provides for the stereo inputs and the second for the mono input, while with a single letter adaptor the mono input is not used.

The fact that specific makes of pickup are included or used as examples, and others omitted, should not be taken to indicate pickup preference or recommendation.

Many pickups are advertised as "high fidelity" types. This is purely a relative term and it is recommended that pickups used with high grade amplifiers and loudspeakers should be specifically intended for such use.

Each control unit is supplied with a Pickup Adaptor. Should this be unsuitable for the pickups in use, the Pickup Adaptor may be exchanged free of charge during the guarantee period, either through the dealer from whom the amplifier was purchased, or in the case of difficulty, through the main distributor for the country concerned (in the U.K. The Acoustical Manufacturing Co. Ltd.) A box in which to return the unit and a special double label are provided to facilitate exchange by post where necessary.

**STEREO PICKUPS TABLE 1**

Manufacturer	Type	Quote Letter	Notes
Acos	GP71 series	E	
Acos	Hi-Light	F	Available as single letter only
BJ	Stereo	E	
B & O	Stereodyne II	A	
Collaro	Studio R	E	
Connoisseur	Stereophonic	B	
Decca	Deram	F	
Decca	Magnetic ffss	A	
ELAC-Stereotwin	200	A	
E.S.L.	C-100	A	
Electro-Voice	21-M series	B	
Fairchild	232	A	
G-E	GC-5	A	
Goldring	700	A	
Grado	Stereo	A	
London-Scott	1000	A	
Ortofon	SC series	B	
Ortofon	SPU-G/T	A	
Pickering	371	A	
Ronnette	BF-40	E	
Shure	M3D/M7D	A	
Tannoy	Vari-twin	A	
Tannoy	Vari-twin Mk. II	A	
Weathers	C501	B	

**MONAURAL PICKUPS TABLE 2**

Manufacturer	Type	Quote Two Letters	Notes
Acos	HGP39	E	
Acos	GP20	E	
Collaro	Studio P, PX	E	
Collaro	TX-88	E	
Connoisseur	Mark II	B	
ELAC-Miratwin	MST-2	B	
E.S.L.	C-60	A	
Fairchild	220/225/230	A	
Garrard	GC-8	E	
Garrard	GMC-5	A	
G-E	VR, VRII	B	
Goldring	500/600	B	
Leak	Mk II	B	
Ortofon	C	B	
Philips	AG 3021	B	
Pickering	350	B	
Ronnette	TO-284-P	E	
Shure	M1	A	
Tannoy	Variluctance	B	
Weathers	MM-1/MM-5	B	

*Example:* An ELAC-Stereotwin is to be used for playing stereo discs, and a Collaro TX-88 is to be used for playing monaural discs: use Pickup Adaptor type AE.

Obtained from Table 1. If no stereo pickup is used, any first letter may be quoted.

Using magnetic output from Weathers pre-amplifier.

82

Lover  
Issue 4

# **QUAD 22**

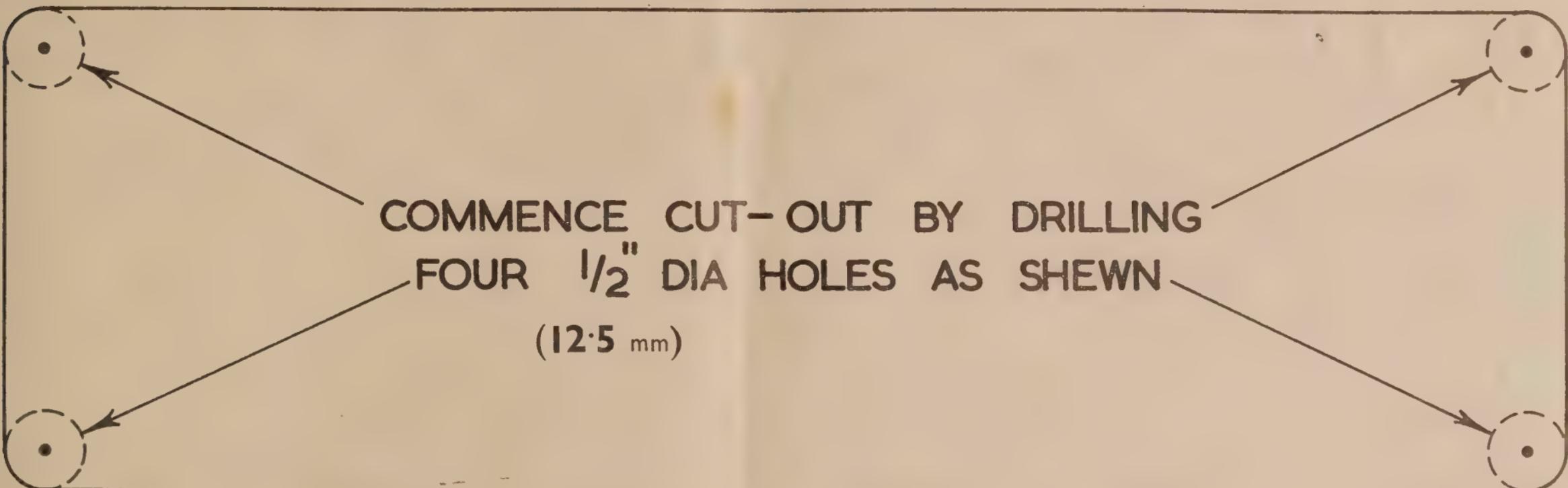
**PICKUP  
ADAPTOR  
UNITS**

**ACOUSTICAL MFG. CO. LTD.  
HUNTINGDON ENGLAND**

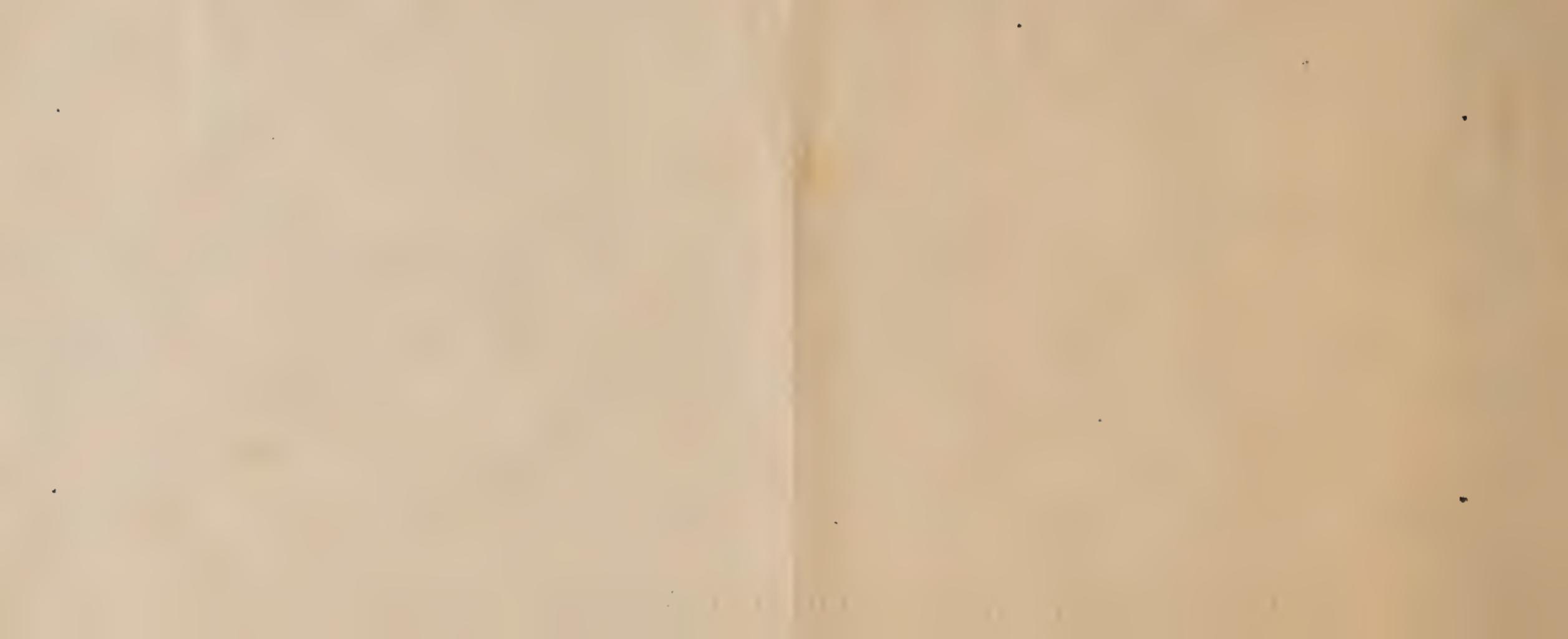
**TEL.: 361 & 574**

← →  
10" (254 mm)

↑  
 $3\frac{1}{16}$ "  
78 mm)  
↓



CUT-OUT TEMPLATE FOR QUAD CONTROL UNITS & TUNERS









**QUAD 22  
CONTROL  
UNIT**

**QUAD II  
POWER  
AMPLIFIER**



**QUAD 22**  
**CONTROL**  
**UNIT**

PAGES 2 TO 14

**QUAD II**  
**POWER**  
**AMPLIFIER**

PAGES 16 TO 22

**QUAD**

For the closest approach to the original sound

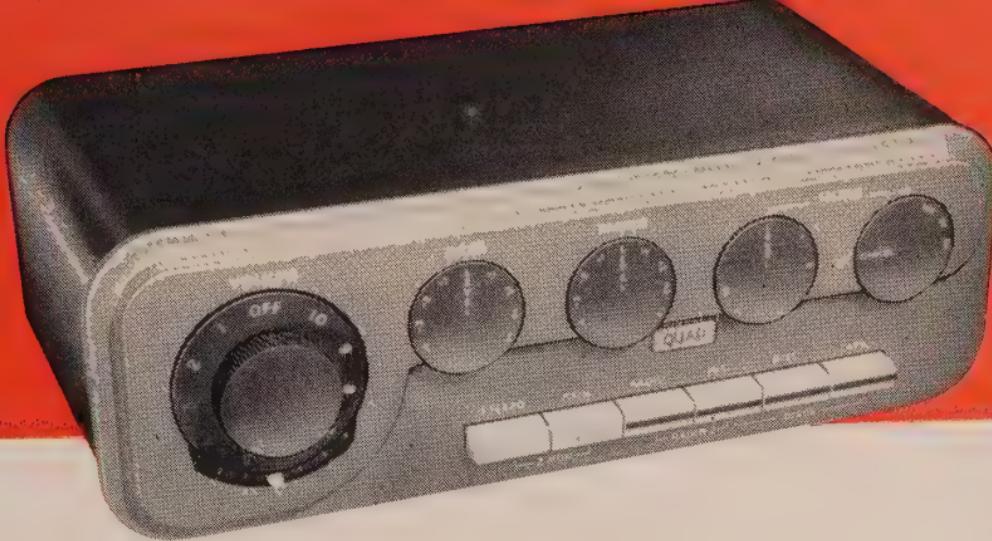
**ACOUSTICAL MANUFACTURING COMPANY LTD.**  
**HUNTINGDON, HUNTS.**

Telephone: 361 and 574

**T**HE objective associated with the name QUAD is the closest approach to the original sound—not as an end in itself, but that the enjoyment and appreciation of music may be unimpeded. The QUAD 22 Control Unit presents further development towards this objective. It incorporates refinements in design, greater flexibility of input and includes facilities for stereo reproduction.



# **QUAD 22 CONTROL UNIT**



The QUAD 22 Control Unit is designed to operate from Discs, Radio, Tape and Microphone, single channel or stereo. Its function is to select any input or service required; to match that input correctly; to amplify it; to apply such corrections as are desirable and to pass the resultant signals to the power amplifiers and hence to the loudspeakers. A separate pair of outputs are suitably

derived to provide facilities for recording on tape any programme currently being reproduced, either single channel or stereo.

The unit is designed to operate with two QUAD II power amplifiers and two loudspeakers. It may, however, be used with a single QUAD II power amplifier and single loudspeaker in which case of course the stereo facilities will become inoperative.

## BASS AND TREBLE CONTROLS

Compensation for the environment in which  
the equipment is used.

## VOLUME CONTROL AND BALANCE



## FILTER SLOPE

Adjusting the filter characteristic for the  
finest quality inherent in the programme.

## FILTER SWITCH

Setting the filtering range.

**PUSH BUTTONS** to select  
service required: Stereo—Single channel  
1 or 2 loudspeakers.

**PUSH BUTTONS** to select  
programme required and to provide  
correct record equalisation.

# PROGRAMME SELECTION



There are six push buttons on the front of the unit. The input required is selected by depressing one or a combination of the four right-hand buttons. The service required—i.e., stereo, single channel on one loudspeaker or single channel on two loudspeakers—is selected by

#### **ACOUSTICAL QUAD 22 RECORD EQUALISATION GUIDE**

**FOR ALL MAKES OF LP AND 45 RECORDS ISSUED SINCE 1954 USE**    
**FOR ALL MAKES OF 78 RECORDS ISSUED SINCE 1954 USE**  

The following equalisations should give the best performance from records issued before 1954. Exceptions occur, particularly when records are made from shared masters. This chart should therefore be used as a guide only. When in doubt use **■** **■** **■** for all pre-1954 records.

ALLEGRO	CETRA - SORIA	EPIC	PERIOD
ALLIED-	COLOSSEUM	ESOTERIC	PHILHARMONIA
AMER REC SOC	COLUMBIA	FELSTED	PHILIPS
ANGEL	COLUMBIA UK (78)	HANDEL SOC	POLYMUSIC
ARCHIV.	COLUMBIA US (78)	HAYDN SOC	RACHM N OFF SOC
ARGO	CONCERT HALL	H M V	R.C.A.
ATLANTIC	COOK	H M V (78)	REMINGTON
AUDIOPHILE	CORAL	LONDON	RENAISSANCE
BACH GUILD	DECCA UK	LYRICHORD	STRADIVARI
BANNER	DECCA UK (78)	MERCURY	SWING
BARTOK	DECCA US	MCM	TELEFUNKEN
BRUNSWICK	D Q G	NIXA	TELEFUNKEN (78)
BRUNSWICK (78)	D Q G (78)	OCEANIC	TEMPO
CAEDMON	DIAL	OSIEAU - LYRE	URANIA
CAPITOL	DURIUM	OXFORD	VANGUARD
CAPITOL (78)	ELEKTRA	PAKLOPHONE	VOX
CAPITOL - SORIA	E M B	PABLOPHONE (78)	WESTMINSTER

means of the remaining two buttons on the left-hand side.

With the stereo button depressed, choice of three stereo inputs becomes available selected by the appropriate button—Radio—Tape\*—Gram.

With the MON (monaural) button depressed, the following single channel inputs become available— Radio 1—Radio 2—Tape—Microphone—Gramophone. In addition there is a choice of four playback characteristics for gramophone, obtained by pressing a combination of buttons in accordance with a chart supplied with each control unit.

By depressing both left-hand buttons, all the monaural facilities are available as already described but reproduced now on both loudspeakers through both power amplifiers.

\*For alternative stereo microphone see page 11



When the single MON button is depressed, so that only one loudspeaker is required, the mains supply is automatically disconnected from the second power amplifier. Similarly the HT supplies to the various tuners are only made alive when the appropriate service is required.

## BASS, TREBLE & FILTER

The treble and bass controls are designed to obtain correct musical balance to suit the environment in which the equipment is used<sup>(1)</sup>. The correct use of these controls is a function of the loudspeaker(s). With a high grade loudspeaker and good programme source, these controls should be at or near level.

The remaining two controls adjust the equipment to suit the useful range of the particular programme material available<sup>(2)</sup> and thus to reproduce the highest quality inherent in that programme. The use of this control is again dependent upon the loudspeaker used. With the highest grade loudspeaker these controls become an essential requirement and they are designed with this application in mind. A cancel position is fitted on the filter switch control. In this position, bass,

## VOLUME CONTROL • BALANCE • ON/OFF

The large knob on the left of the panel provides volume adjustment and this is combined with the On/Off switch for the complete equipment. The QUAD nameplate is illuminated when the equipment is switched on.

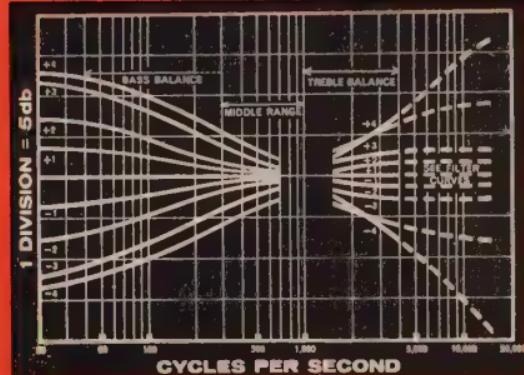
Slotted immediately beneath the volume control is the balance control. This adjusts the relative volume level to the two loudspeakers. With proper control in record manufacture this control should require little attention after being set for any installation.

treble, and filter controls are automatically by-passed to give a level response. Thus a switched reference standard is provided for comparison with control settings found by aural assessment.

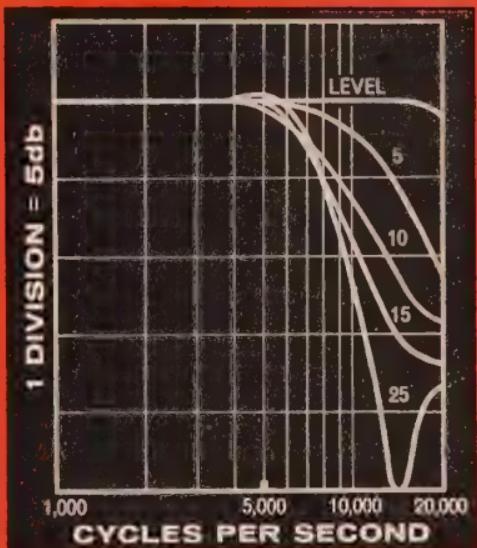
Full instructions for the proper use of these controls are supplied with each equipment.

(1) Bass and treble control is effected in two frequency discriminating networks of identical impedance, one in the signal chain and one in a feedback chain. Boosts and cuts are therefore symmetrical. The bass control varies both slope and turnover. The treble operates midway between variable step and variable slope in order to facilitate adjustment of musical brilliance while maintaining natural harmonic balance.

(2) The filter is of the "m" derived type with " $m$ " = 0.85. The filter may be switched in half octave steps and the slope is continuously variable from zero. This arrangement gives the widest frequency range for minimum distortion from nearly all programme sources. In the 7 Kc/s position the filter is similar to its predecessor but is now under-damped at 5 Kc/s and over-damped at 10 Kc/s, this being the better configuration for practical requirements. The calibration has been altered to show the approximate attenuation over the first octave rather than a theoretical final slope, thus producing a more linear scale and a closer match to the subjective effect.



Curves showing slopes of response provided by the bass and treble controls.



Curves showing the range of the 7K filter continuously variable from level to 25 db/octave. The curve shapes are accurately maintained, the figures adjacent to the curves being the approximate dial settings. The 5K and 10K filters provide similar curves one half octave up or down.

**TAPE OUTPUTS**

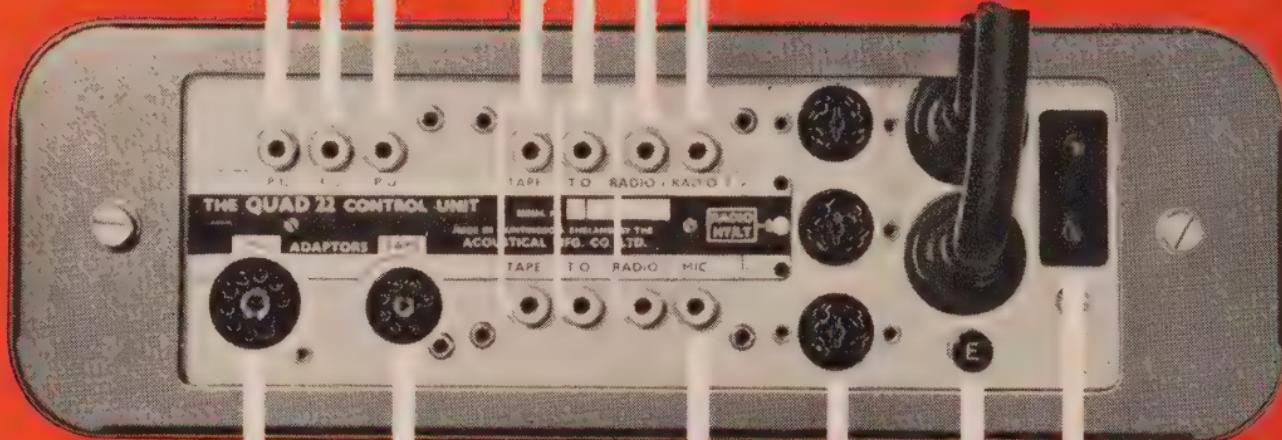
**RADIO INPUTS**

**TAPE INPUTS**

**RADIO 2 INPUT**

**PICKUP INPUTS**

**CABLES TO POWER AMPLIFIERS**



**PICKUP ADAPTOR**

**MAINS INPUT**

**TAPE ADAPTOR**

**EARTH TERMINAL**

**MICROPHONE INPUT**

**HT/LT SOCKETS**

## PICK-UP INPUT

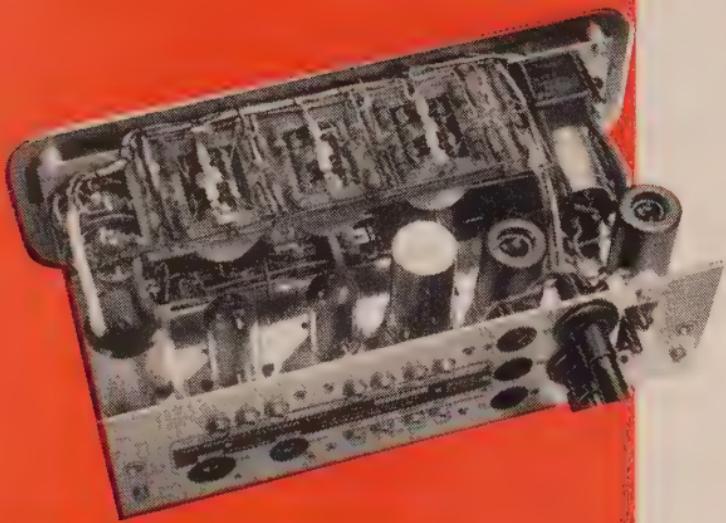
## THE REAR PANEL

The gramophone input consists of three inputs and an adaptor unit. Two of these inputs form the stereo pair and the third input is for use with a separate monaural pickup. There are two ranges of adaptor units. One range is designated by a single letter and when one of this range is employed, monaural reproduction is automatically taken from the lateral output of the stereo pickup. Thus one pickup is used for all types of record. The second range of adaptors is designated by two letters and when one of these is employed the input for monaural records is automatically taken from the separate input provided.

Correct matching for a pickup is very important, and this entails the adjustment of several parameters for proper operation. The adaptor unit carries out this function in a unique manner so that correct operating conditions are ensured (3). The range of adaptor units provides separately for the stereo and monaural inputs, so that when two pickups are used they may be of entirely different types.

A list showing the appropriate unit for various pickups is published and this is revised from time to time as new pickups become commercially available. An adaptor is supplied with each control unit and an exchange service is available in most Countries throughout the World.

(3) The pickup input is fed to the first stage over which parallel feedback is applied. The adaptor unit in applying the correct load for the pickup also adjusts the impedance of the feedback circuit to suit that load. In this way noise is virtually that of the thermal noise in the pickup load impedance alone. It will be seen that, particularly with pickups requiring medium and low impedance loads, the signal to noise can be improved several dB over that of fixed high impedance parallel feedback of equivalent gain. The limit is reached with a load of 12 Kilohms, the noise with any load impedance below this value being that of the equivalent noise of a 12 Kilohms resistance at the input. The adaptor also adjusts the total stage gain together with the type of compensation required when pickups of other than constant velocity types are employed.



## RADIO INPUTS

Three radio inputs are provided together with three HT and LT supplies. Two of these—Radio 1 and Radio 2—provide alternative radio inputs available monaurally. The third input forms a stereo pair with Radio 1, either from a separate receiver or multiplex unit. It is possible to connect Radio 1 and Radio 2 so that they automatically couple as a stereo pair in the rare case where this may be required.

## TAPE INPUT & OUTPUT

Tape input and tape output are provided, available for monaural or stereo. The tape inputs (playback) are interconnected via a plug unit which is normally

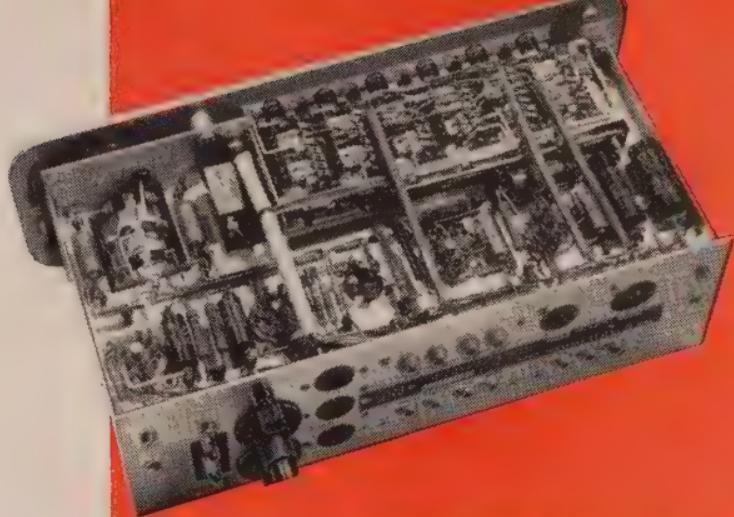
arranged so that the input is taken from a properly corrected tape pre-amplifier channel, this being the recommended procedure for professional standards. Alternative plug units make it possible to convert this pair of inputs for stereo microphone use (type MIC N unit) or to provide for any other input configuration which future requirements may demand (4).

The tape output (for recording) feeds signals selected by the push-buttons to the record amplifier of a tape machine. Gramophone signals are suitably equalised and amplified to the correct level, otherwise this output is unaffected by volume, tone or filter controls.

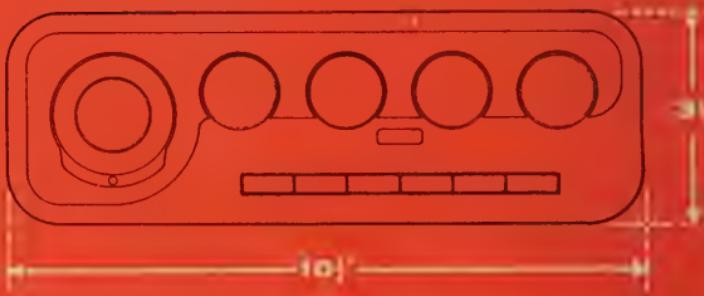
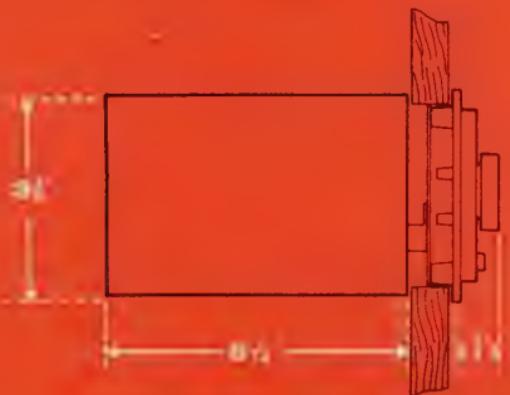
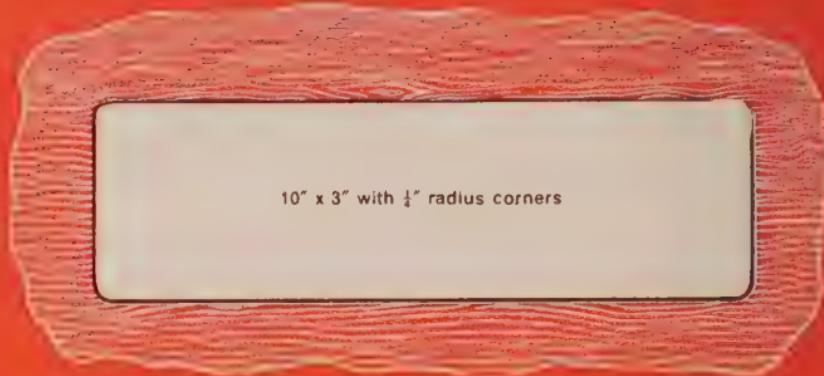
## MICROPHONE

A high gain microphone input is provided and is available monaurally (but see paragraph above).

(4) Down to a basic sensitivity of 400 µV rms.



The Control unit may be fitted to cabinet panels of any thickness from  $\frac{1}{2}$ " to  $\frac{3}{4}$ ".  
The cut-out required is shown on the right.  
The cover is removed and the unit inserted from the front when it will locate automatically.  
The cover is refitted from the rear and will grip the unit firmly in position.



# SPECIFICATION

## FREQUENCY RESPONSE

Cancel position: Radio and Tape inputs: 20-20,000 c/s  $\pm$  0.5 dB.  
" " Microphone: 20-20,000 c/s  $\pm$  2 dB.  
" " Gramophone Maintained over 20-20,000 c/s  
within  $\pm$  1 dB of the following characteristics:

<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3180 $\mu$ s	318 $\mu$ s	75 $\mu$ s.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3180 $\mu$ s	318 $\mu$ s	100 $\mu$ s.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3180 $\mu$ s	450 $\mu$ s	50 $\mu$ s.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	—	450 $\mu$ s	25 $\mu$ s.

Bass and treble controls:  $\pm$  1.5 dB of published curves.  
Filter frequencies. 5 Kc/s, 7 Kc/s, 10 Kc/s.  
Filter slope: See curves.

## INPUT SENSITIVITY (at 1 Kc/s for 1.4 Vrms output)

Radio: 70 mVrms, load impedance 100,000 ohms.  
Tape: 70 mVrms, " 100,000 ohms.  
Microphone: 1.5 mVrms, " 100,000 ohms.  
Pick-up: Depending upon adaptor unit. Basic sensitivity prior to compensation 400  $\mu$ Vrms.

## DISTORTION (1.4 Vrms output):

All controls level: Any input: 0.02%.  
Least favourable arrangement of controls: less than 0.1%.

## NOISE

Total hum and noise: Better than -70 dB.  
Noise: -80 dB or where applicable, the equivalent noise of  
the pick-up load impedance at the input.

## OUTPUT

Control unit to power amplifier: 1.4 Vrms  
Maximum cable extension 20 feet at 30 pF per foot.  
Tape outputs: Peak signal approx. 0.25 Vrms  
Maximum loading 500,000 ohms and 200 pF.

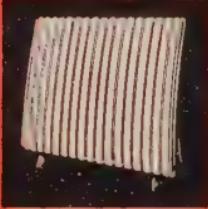
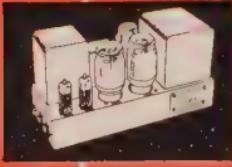
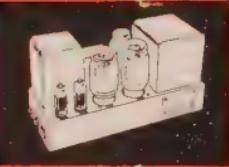
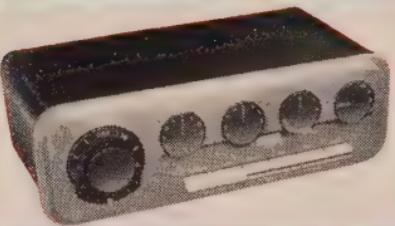
## INTERCHANNEL SPECIFICATION

Cross talk: Better than 40 dB 20-20,000 c/s.  
Gain stability: With any volume setting and tone controls level: Less than 1 dB between channels.  
With any volume setting and tone controls varied: Less than 2dB between channels.  
Balance control: Provides up to 9 dB unbalance either way.

## POWER SUPPLY

The unit takes its power from the main amplifier as follows:—  
330 V 4 mA. | Plus current taken by tuner units.  
6.3 V 1.1 A. | Maximum power available from tuner sockets:  
330 V 35 mA each tuner.  
Rad. 1 and Rad. 2: 6.3 V 3 A total.  
Rad. 1 (2nd channel): 6.3 V 3 A.  
The heater supply is C.T. to chassis.

continued overleaf



## VALVES

2 x EF86 (Z.729 or 6267),  
2 x ECC83 (12AX7).

## MECHANICAL

Front panel: Die cast, stove finished silver fawn.

Knobs: Matt brown.

Chassis: Steel: Cadmium plated.

Cover: Steel: Stoved steel grey.

The complete unit is electrically and mechanically suitable for use in all climatic conditions.

**QUAD II  
POWER  
AMPLIFIER**

**PAGES 16 TO 22**

**Q U A D**

**for the closest  
approach to the  
original sound**



One or two QUAD II power amplifiers may be used with the QUAD 22 control unit depending upon whether single channel only or single channel and stereo reproduction is required.

The function of the power amplifier is that of amplifying the output from a control unit or other source with the highest possible standard of accuracy. The unexcelled quality of reproduction provided by the QUAD II is recognised

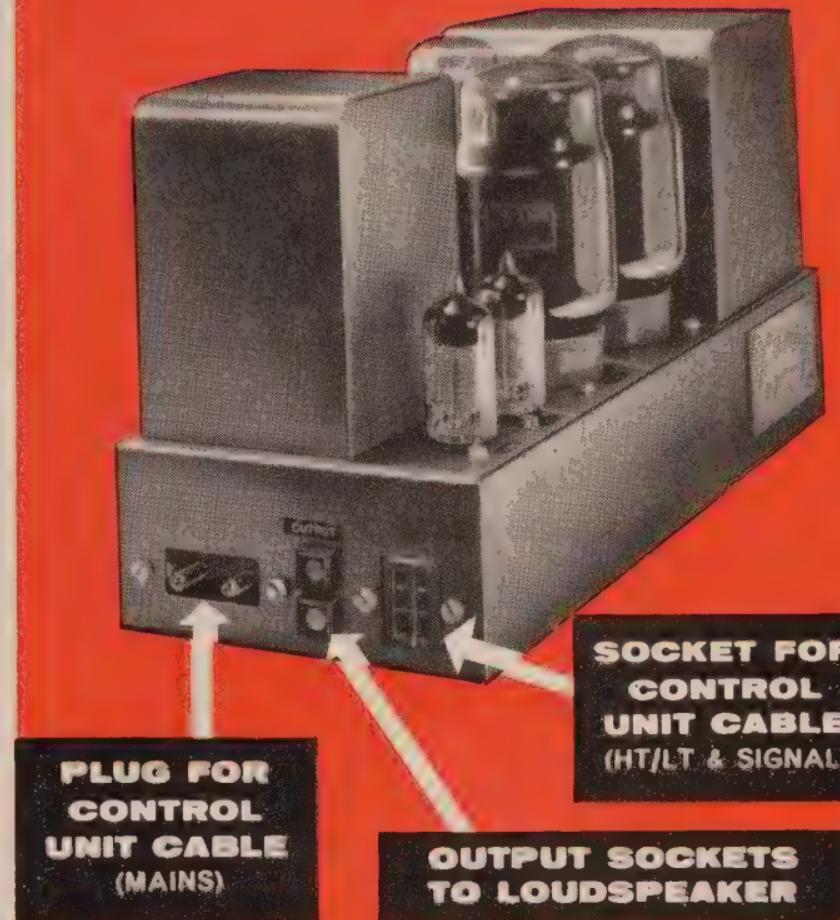


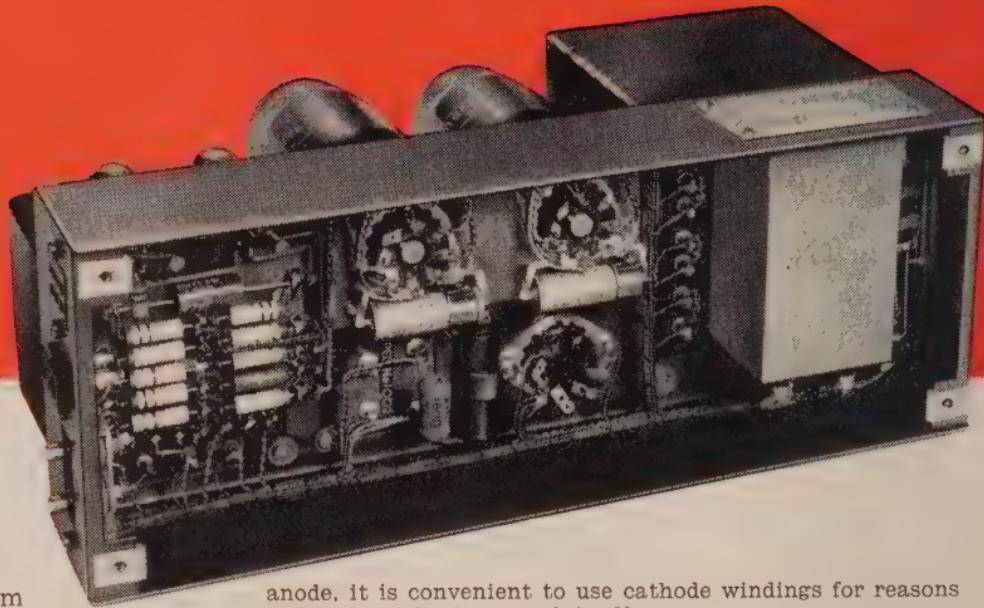
throughout the world and several features contribute to maintain this standard through many years of service with the minimum of attention. Stability and hence performance are entirely independent of load or signal conditions. It is thus suitable for use with any loudspeaker configuration, the quality of reproduction being solely that imposed by the limitations of the loudspeaker selected (and of course that of the programme input).

The performance specification is fully maintained with random valve replacements from standard commercially tested valves without matching or alignment of any kind.

Although high power output valves are used these are not operated at their maximum power. The designed power output is selected to be adequate for all home music listening with low sensitivity loudspeakers.

The amplifier is suitable for use in all climatic conditions and is available for operation from all AC mains supplies.





The QUAD II power amplifier differs from contemporary practice both in the output stage and in the penultimate stage.

#### THE OUTPUT STAGE

The basic principles utilised in the output stage design have been treated elsewhere\* and need only brief reference here. It has been shown that by proportioning the influence of screen and anode currents on the load, a series of operating conditions may be obtained offering low distortion and high efficiency. Since cathode current is common to screen and

anode, it is convenient to use cathode windings for reasons which have also been explained\*

The output stage as used in the QUAD II appears before feedback is applied as the equivalent push-pull triode circuit as far as amplification and effective output impedance are concerned but with less than half the distortion and an increase of 40% in efficiency over the equivalent triode circuit. The screen and anode circuits are more favourably arranged for efficient smoothing, a factor which is reflected in the overall size of the equipment.

\**Wireless World*. Sept., 1952.

The output transformer employs five windings sub divided into fourteen sections coupled so that the output stage phase shift is extremely small within the range where the overall feedback loop gain exceeds unity. The small size of the output transformer resulting from optimum choice of flux and material should be noted.

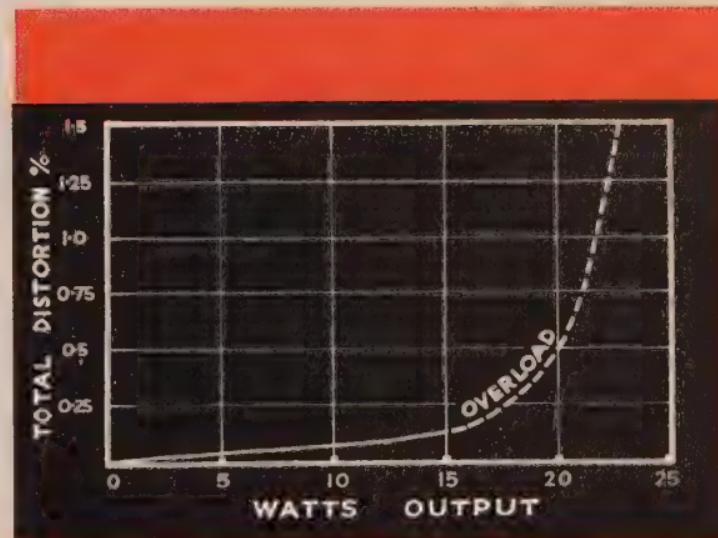
### THE PENULTIMATE STAGE

Full benefit can only be obtained from this output circuit if the feed is accurately balanced throughout the frequency range, since it is some three times more sensitive to unbalance than conventional operation. A high stage gain is desirable and some form of see-saw circuit is called for. Such circuits, however, are unsymmetrical in relation to the HT supply. In the QUAD II, two EF.86 valves are used, each feeding one output valve. The second EF.86 is fed from the first but with a signal 6 dB lower than would be required for balance. The EF.86's are then coupled through their screens and cathodes so that they are always approaching balance. This arrangement is inherently stable, satisfies symmetry requirements and the balance error is automatically maintained through see-saw action. The output valve grid returns are applied to a fixed signal point in phase with one and out of phase with the other, the small signal so applied being equal to the small resultant balance error previously mentioned. In this way, the complete phase change centres around balance and provided the anode load resistors are of equal value, any error due to valve mismatch will be small.

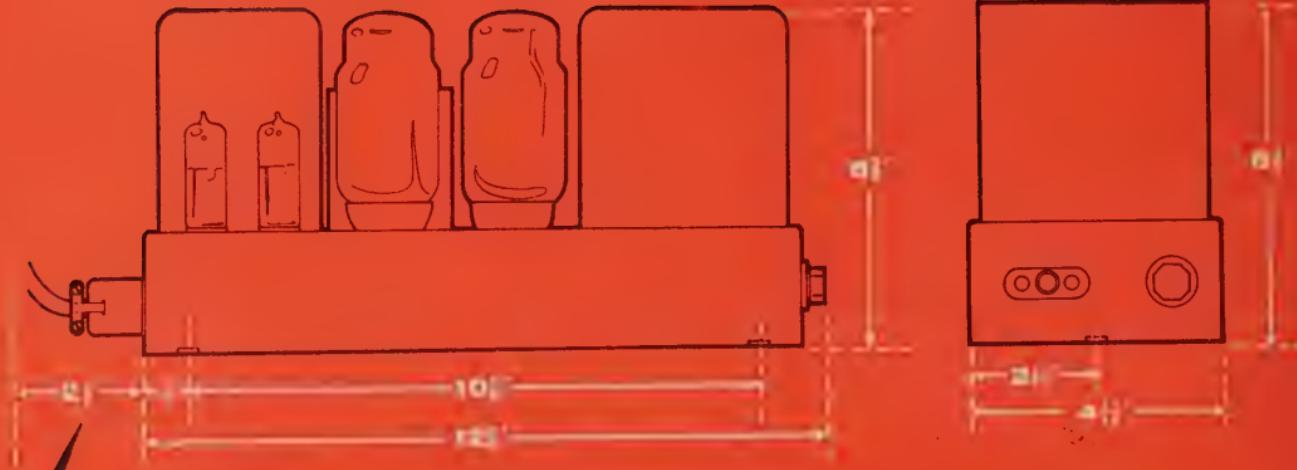
### FEEDBACK AND LINEARITY

The overall feedback is an integral part of the amplifier design and cannot be considered separately.

The standard of pass figures for distortion is, of course, well below audibility, no matter how refined the test. They are given in full because only in this way do they give a proper indication that the amplifier is operating exactly as intended and not by part cancellation of distortion from one stage to another by fortunate valve selection.



Linearity and overload of the QUAD II power amplifier.



To allow for  
insertion  
of plug

The QUAD II Power amplifier dimensions are given above. In fitting in a cabinet, 2½" either end should be allowed for easy access to the fuse and input and output leads. It may be fixed in position by means of the two tapped holes in the baseplate.

# SPECIFICATION

## POWER OUTPUT

15 watts throughout the range 20-20,000 c/s.

## FREQUENCY RESPONSE

Within 0.2 dB 20-20,000 c/s.

Within 0.5 dB 10-50,000 c/s.

## DISTORTION (measured at 12 watts output)

Total 3rd and higher order: less than 0.1% at 700 c/s.

Higher order alone: less than 0.03% at 700 c/s.

Valve mismatching up to 25% (introducing 2nd harmonic) not to cause distortion to exceed 0.18%. Total distortion at 50 c/s not to exceed 0.25%.

## INPUT

Sensitivity: 1.4 Vrms for 15 watts output.

Load imposed on input: 1.5 Megohms in parallel with 10 pF.

## BACKGROUND

80 dB referred to 15 watts.

## OUTPUT IMPEDANCES

15 ohm and 7 ohm.

Effective output resistance: 1.5 ohm for 15 ohm output.

## POWER SUPPLIES

INPUT: 200-250 V. AC single phase (or 95-125 V. AC)  
40-80 c/s.

90 watts consumption (excluding control unit,  
tuners, etc.).

HT AND LT supplies available for external equipment:  
330 V. 40 mA.  
6.3 V. 4 A. (heater C.T. to chassis).

VALVES 2 x EF.86 (Z.729 or 6267), 2 x KT.66 (5883 or  
6L6G matched), 1 x GZ.32 (54KU. or 5V4G).

WEIGHT 18½ lbs. (8.3 Kg.).

DIMENSIONS 13" x 4¾" x 6½". See drawing.

MECHANICAL All windings impregnated and housed in compound filled casings. All metal work fully rust-proof processed and stoved steel grey. Metal work, rust-proofing, finishing, transformer winding, tropicalisation, assembly and tests, all carried out under constant supervision by our AID approved inspection section. The equipment is suitable for use under all climatic conditions.

## **SPECIAL APPLICATIONS**

The reliability and consistent performance of the QUAD II power amplifier has led to its wide use in professional, industrial, and scientific applications. The unconditional stability allows any number of units to be connected in parallel without interaction. The flexibility of multiple unit operation is of value where increased power is required, and where it is necessary to retain the excellent characteristics of a single QUAD II power amplifier.

## **NON-STANDARD VERSIONS**

The QUAD II power amplifier can be supplied with certain variations, for example:

- (a) Input to bridge 600 ohm lines at zero level and fitted with gain control.  
For use as recording, broadcast, or television sound monitor amplifier.
- (b) Fitted with single multi-way Tuchel plug for all external connections.  
For use in rack mounted broadcast applications.
- (c) 50/100 Volt line output. For use in local programme distribution or warning systems.
- (d) 115/230 Volt output. For use as artificial mains supply to drive small synchronous motors from quartz crystal controlled or variable frequency sources.

Such non-standard amplifiers are only available in quantity to special order.

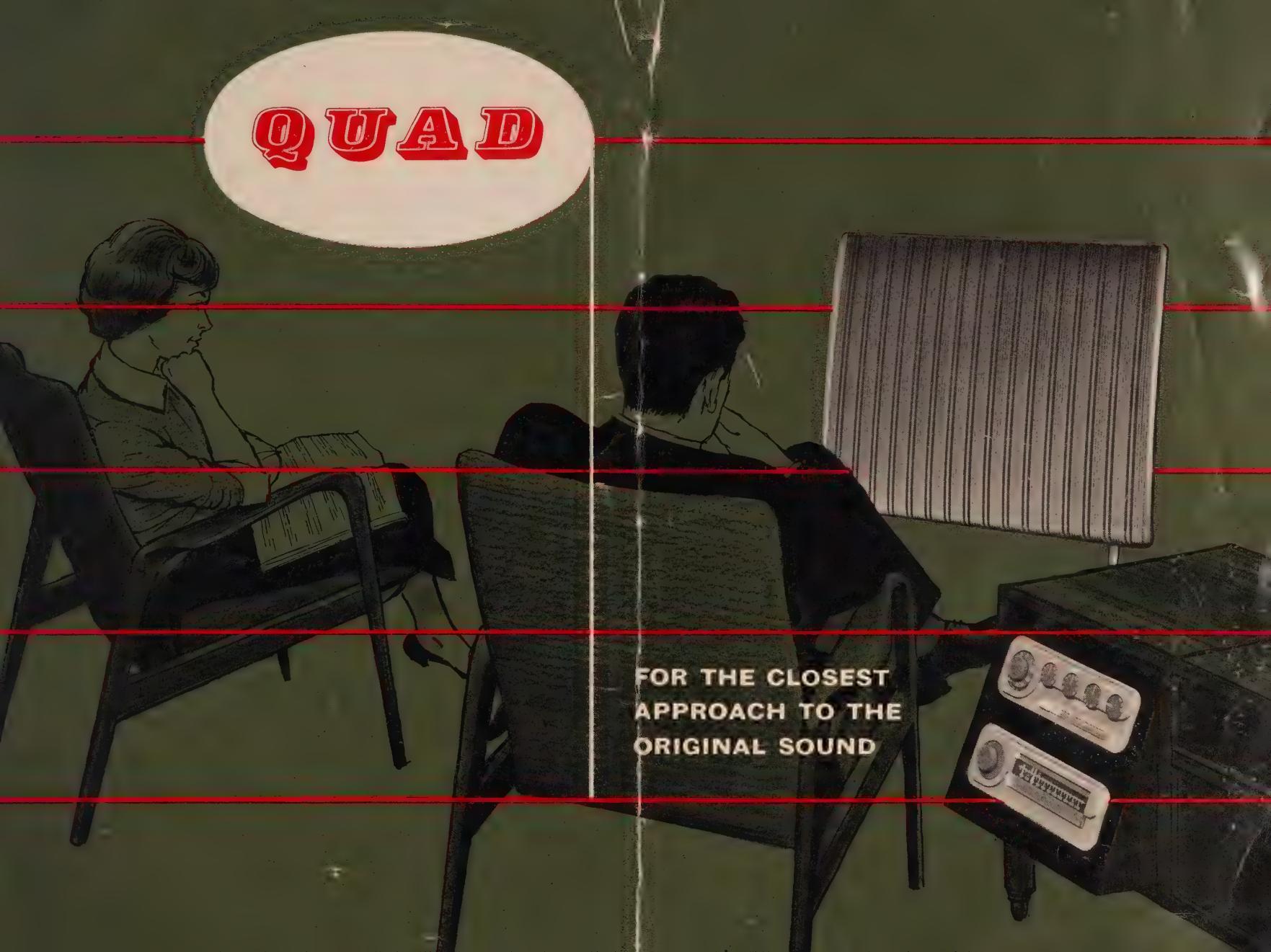
## **PRICES**

# Guarantee

*This instrument is guaranteed against any defect in material or workmanship for a period of twelve months from the date of purchase. We undertake to replace within this period, free of charge, such parts (excepting valves which are covered by the Manufacturer's Guarantee of three months) as may prove on examination to be defective provided this is not the result of misuse, accident or negligence and that the instrument was purchased at our full current retail price.*

**Q U A D**

**FOR THE CLOSEST APPROACH TO THE ORIGINAL SOUND**



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ORIGINAL SOUND

**QUAD**

**FOR THE CLOSEST APPROACH TO THE ORIGINAL SOUND**

HONG KONG  
Kowloon,  
31 Nathan Road,  
The Radio People Ltd.,  
Sole agent



## QUAD EQUIPMENT

This leaflet describes in general terms the Quad range of units, designed to provide the highest standards of reproduction of recorded or broadcast music attainable with modern techniques. You are invited to write for booklets describing each unit in greater detail.

### QUAD 22

Pre-amplifier/control unit providing full facilities for both mono and stereo operation.

### QUAD II

Power amplifier, 15 watts output.

### QUAD AM II

Radio tuner for long, medium and short wavebands.

### QUAD FM

Radio tuner for VHF/FM reception.

### QUAD LOUDSPEAKER

Full range electrostatic loudspeaker.



### AM II TUNER

TUNING RANGE: AM II/European

Long wave: 2070-800 metres

Medium wave: 588-185 metres

Short wave: 5-8-18-5 mc/s

AM II/Overseas

Medium wave: 510-1620 kc/s

Short wave: 1: 2-2-6-6 mc/s

Short wave: 2: 5-8-18-5 mc/s

OUTPUT LEVEL: 100mV (Nominal for 30% modulation)

OUTPUT RESISTANCE: 15,000 ohms

FILTER REJECTION: AM II/European: 9 kc/s

FREQUENCY: AM II/Overseas: 10 kc/s

POWER: HT 35 mA at 330V

REQUIREMENT: LT 1-2 A at 6.3V

POWER AND SIGNAL CABLE LENGTHS: 40" (1m.)

VALVE COMPLEMENT: EF 89, ECH 81, EBF 89, EM 84

### QUAD TUNERS

Quad tuners are designed primarily for use with Quad amplifiers and are similar in size, appearance, and method of mounting to the Quad 22 control unit.

They draw their power supplies from the outlets on the control unit and are controlled by the Quad 22 pushbuttons. The L.T. supply, however, is not switched and the tuners are therefore always ready for use whenever the amplifier is on. Connecting leads are fitted ready to plug into the control unit.

Both tuners are designed to provide the highest quality of reproduction inherent in their respective programme transmissions and must, of course, be chosen to suit the broadcasts to be received. Local reception conditions will usually determine the most suitable type of aerial and the local dealer specialising in this field will be in the best position to advise on this point.

The AM II Tuner is made in two models covering different wavebands to suit requirements in different parts of the world and both AM and FM tuners are suitable for use under all climatic conditions.

The tuning scale is of  $\frac{3}{4}$ " Perspex machine engraved and silk screened, filled white and red and finished gold on a matt brown background. Accurate and positive tuning indicators are fitted to both models.

Dimensions:  $10\frac{1}{2}'' \times 3\frac{1}{2}'' \times 6''$ . Weight: 6 lb. (2.7 Kg.).

For other comment see:-  
QUAD AM II TUNER. Hi Fi News, October, 1960; Gramophone, October, 1960; Records and Recording, November, 1960.  
QUAD FM TUNER. Wireless World, September, 1955; Record Review, February, 1956; Gramophone, September, 1960; Hi Fi News, February, 1961.

### FM TUNER

TUNING RANGE: 87.5-108 mc/s

SENSITIVITY: 3.2V for 20 dB quieting.

OUTPUT: 100 mV at 100,000 ohms impedance (to be terminated by 100,000 ohms across amplifier input).

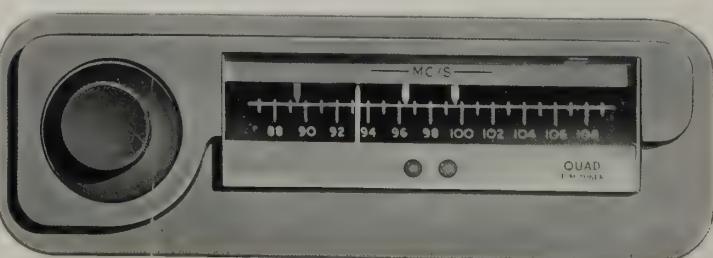
CONSUMPTION: 6.3v 1.85A; 330v 27 mA.

VALVES: 6BH6; 12AT7/ECC81; 6BJ6;

6BH6; 6AU6; GAL5/EB91;

12AX7/ECC83; neons Hivac

CC11L; lamp 6.5v 0.3A.



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Kowloon,  
**HONG KONG**

.0006 in.) Spherical		Hz	1 kHz	grams	10,000 Hz - 19 cm/sec at 1 gram
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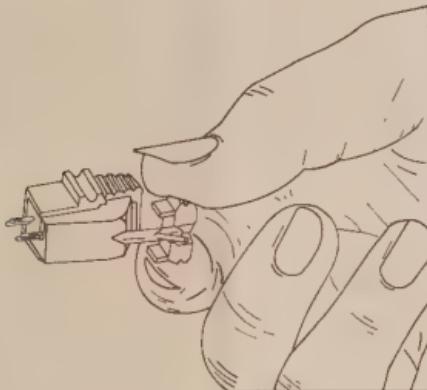
\*Output voltages given for stereo cut record. For MONO cut record, output voltage at both left channel and right channel cartridge terminals will be 71% of figures above.

\*\*Tracking forces greater than maximum indicated should not be used.

NET WEIGHT: .3 grams

FOUR-CHANNEL: These Stereo Dynetic® Styli are compatible with all four-channel matrix systems.

MONOPHONIC OPERATION: Set function switch on amplifier to "MONO" or "A+B." If amplifier is not equipped with this switch, connect left and right channels in parallel.



### STYLUS REPLACEMENT

STYLUS REPLACEMENT: Grasp molded housing of stylus and gently pull forward out of cartridge. Insert replacement stylus into socket and press until housing mates with cartridge case.

RECOMMENDED STYLUS CLEANING: Use a camel's hair brush (No. 2 size or smaller), trimmed to approximately 6 mm (1/4 in.), dipped in alcohol or an alcohol-distilled water solution. Commercial cleaning solutions may cause stylus damage or corrosion. Always brush stylus from back to front; never brush or wipe stylus from front to back or side to side.

### TO PRESERVE STYLUS LIFE:

1. Follow turntable or tone arm instructions when adjusting antiskating force.
2. Do not handle the tone arm while it is in operation since this may cause the arm to sweep across the record.
3. If it is necessary to manually place the tone arm in the record groove while turntable is rotating, release it as soon as the stylus engages the record groove.
4. Correct improper set-down adjustment or malfunction of the turntable changing mechanism to prevent the stylus from striking the edge of the turntable or record. Do not stack more records than turntable manufacturer recommends.
5. Take care to properly insert the stylus into the cartridge assembly and

## QUAD 22 CONTROL UNIT

The Quad 22 control unit provides full facilities for either mono or stereo operation. Used with one power amplifier the Quad 22 provides full mono facilities; used with two power amplifiers it provides for both mono and stereo; both channels may also be used for mono when required, by pressing the "2 MON" pushbuttons.

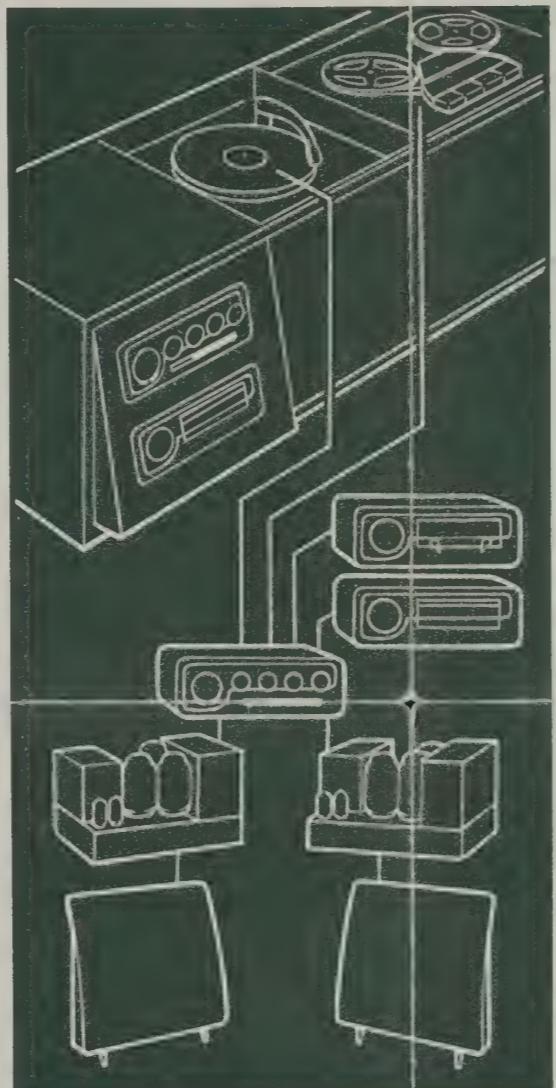
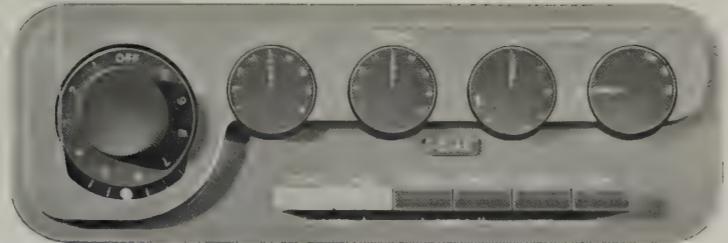
Three easily distinguished types of control are used for the three main functions of selecting programme, adjusting volume and modifying signal as to tone, range, etc. The Control unit is compact, easily mounted (or may be used free standing if preferred) and combines simplicity and rigidity with a "clean" finish.

The six pushbuttons perform 19 different functions, all clearly marked. Two provide for selection of stereo or mono, or two channel mono, and also switch the second amplifier on or off as required. The other four select the programme source in either stereo or mono from radio, microphone, disc (with 4 different equalisation characteristics) or tape.

Sockets are provided for permanent connection of all radio tuners, pickups, tape recorders, or microphones used with the unit.

An exchangeable plug-in adaptor unit is provided with each control unit for pickup matching, together with a list showing the types required for various pickups. A chart is also provided showing the pushbutton combination required to provide correct equalisation for different makes of record, old and new. Tape recordings (mono or stereo) may be made without affecting normal listening to the programme being recorded, and replayed either via the tape recorder pre-amplifier or direct from the head with compensation for any characteristic. A comprehensive booklet supplied with the unit gives full instructions for installation and operation as well as parts lists, photographs for component identification, circuit diagrams and mounting templates.

*For other comment see:- Gramophone, April 1959; Records and Recording, April 1959; Hi Fi News, April 1960; High Fidelity, October 1960; Design, December 1960.*



## QUAD II POWER AMPLIFIER

The QUAD II power amplifier contains no controls and may therefore be mounted inside the cabinet, leaving only the control unit panel (and that of the radio tuner if fitted) visible on the outside. Stability, and hence performance, are entirely independent of signal or load conditions and the amplifier is therefore suitable for use with any loudspeaker arrangement.

The performance specification is fully maintained with random replacements from normal valve stocks without the need for matching or alignment of any kind, and the output stage uses the now traditional QUAD cathode coupled arrangement combining low distortion with an efficiency which is reflected in the compact size of the equipment.

WEIGHT: 18½ lbs. (8.3 Kg.). DIMENSIONS: 13" x 4¾" x 6½".

MECHANICAL: All windings are impregnated and housed in compound filled casings. All metalwork fully rust-proof processed and stoved steel grey. Metalwork, rust-proofing, finishing, transformer winding, tropicalisation, assembly and tests are all carried out under the constant supervision of our approved inspection section. The amplifier is suitable for use under all climatic conditions.

POWER OUTPUT	15 watts throughout the range 20-20,000 c/s
INPUT	Sensitivity: 1.4 Vrms for 15 watts output
FREQUENCY	Within 0.2 dB 20-20,000 c/s
RESPONSE	Within 0.5 dB 10-50,000 c/s
DISTORTION	Total third and higher order: less than 0.1% at 700 c/s. Higher order alone: less than 0.03% at 700 c/s
(measured at 12 watts output)	
BACKGROUND	80 dB referred to 15 watts
OUTPUT IMPEDANCE	Effective output resistance: 1Ω for 15Ω output
POWER SUPPLIES	Input: 200-250vAC single phase (or 95-125vAC 40-80 c/s) 90 watts consumption (excluding control unit, tuners, etc.) Valves: 2 x EF.86 (Z.729 or 6267), 2 x KT.66 (5883 or 6L6G matched), 1 x GZ.32 (54KU or 5V4G)



## SPECIFICATION

### FREQUENCY RESPONSE

Bass and treble controls: ±1.5dB of curves shown. Filter frequencies: 5 Kc/s, 7 Kc/s, 10 Kc/s. Filter slope: See curves.

### CANCEL POSITION

Radio and Tape inputs: 20-20,000 c/s ±0.5dB Microphone: 20-20,000 c/s ±2dB

Gramophone:	Maintained over 20-20,000 c/s within ±1dB of the characteristics opposite:
3180μS	318μS
3180μS	318μS
—	450μS
3180μS	450μS
—	25μS

### INPUT SENSITIVITY

Radio and Tape: 70mVrms. Load impedance 100,000 ohms. Microphone: 1.5mVrms. Load impedance 100,000 ohms. Pickup: Depending upon adaptor unit. Basic sensitivity prior to compensation 400mVrms.

### DISTORTION

(1.4 Vrms output): All controls level: Any input: 0.02%. Least favourable arrangement of controls: less than 0.1%.

### NOISE

Total hum and noise: Better than -70dB. Noise: -80dB or where applicable, the equivalent noise of the pickup load impedance at the input.

### OUTPUT

Control unit to power amplifier: 1.4 Vrms. Tape outputs: Peak signal approx. 0.25 Vrms. Maximum loading: 500,000 ohms and 200 pF.

### INTERCHANNEL

Cross talk: Better than 40dB 20-20,000 c/s. Gain stability: With any volume setting and tone controls level: Less than 1dB between channels. With any volume setting and tone controls varied: Less than 2dB between channels. Balance control: Provides up to 9dB unbalance either way.

### POWER SUPPLY

The unit takes its power from the power amplifier as follows: 330 V 4mA plus current taken by tuner units: 6.3 V 1.1 A plus current taken by tuner units. Maximum power available from tuner sockets: 330 V 35 mA each tuner. Rad 1 (Yellow) and Rad 2: 6.3 V 3 A total. Rad 1 (Blue): 6.3 V 3 A. The heater supply is C.T. to chassis.

### VALVES

2 x EF86 (Z.729 or 6267). 2 x ECC83 (12AX7).

### DIMENSIONS

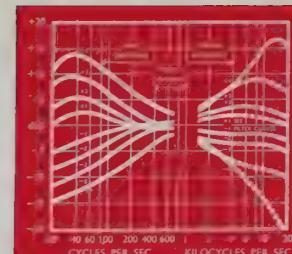
10½" x 3½" x 6".

### WEIGHT

6½ lbs. (3.1 Kg.).

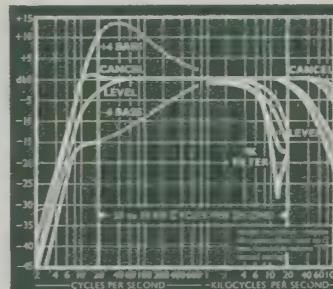
### MECHANICAL

Front panel: Die cast, stove finished silver fawn. Knobs: Matt brown. Chassis: Steel, Cadmium plated. Cover: Steel, stoved steel grey. The complete unit is suitable for use in all climatic conditions.



These curves show the slopes of response provided by the bass and treble controls and the manner in which the filter may be adjusted to provide the widest possible frequency range consistent with minimum distortion in each programme.

The filter curves show the performance in the 7K position. In the 10K or 5K position these curves are displaced one half octave up or down respectively. The cancel position provides a useful reference standard for comparison purposes.



## QUAD ELECTROSTATIC LOUDSPEAKER



The Quad Electrostatic Loudspeaker is the world's first wide-range electrostatic loudspeaker.

Utilising closely coupled moving elements some two hundred times lighter than diaphragms of moving coil loudspeakers, the air is enabled to follow the electrical impulses with far greater precision than was previously possible.

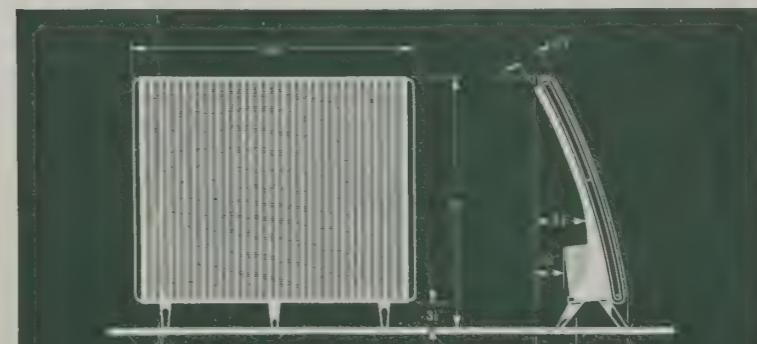
The loudspeaker is extremely analytical and much of the recent improvement in gramophone records can be directly attributed to its use for studio monitoring and quality control. It is designed for use in rooms of up to 5,000 cubic feet.

For the listener "it represents, by a wide margin, the closest approach to truly natural reproduction of sound in the home that we have yet heard". (American High Fidelity magazine H.H. Lab. report November 1960.)

The speaker is completely enclosed within expanded metal grilles with polished wood end frames and feet, and is suitable for use under normal domestic living conditions throughout the world.

It is essential for both proper performance and reliability that this loudspeaker be used only with a QUAD amplifier or one specially designed for use with this loudspeaker.

*For other comment see:- Record News, April, 1956; High Fidelity, June, 1956; Radio och Television, November, 1956; Hi-Fi News, November, 1957; Saturday Review, November, 1957; Revue du Son, January, 1958; Record Review, July, 1958; High Fidelity, July, 1958; Toute la Radio, October, 1959; Evolution Electronique, December, 1959; High Fidelity, November, 1960; Elektrowirksschaft, December, 1960.*





SHURE

MICROPHONES AND ELECTRONIC COMPONENTS



AREA CODE 312/866-2200 • CABLE: SHUREMICO

TWX: 910-231-0048

TELEX: 72-4381

## THE PREMIER FAMILY OF STEREO SOUND REPRODUCERS

**MODELS  
N91GD AND  
N91ED**
**STEREO DYNAMIC®  
PHONOGRAPH STYLUS  
FOR MODELS M91ED, M91GD  
AND DUAL MODEL DM101MG  
AND DM103ME CARTRIDGES**
**STYLUS SPECIFICATIONS**

Replacement Stylus	Stylus Grip Color	Output (1 kHz at recorded peak velocity)*	Frequency Response	Channel Balance	Channel Separation (minimum)	Tracking Force**	Trackability (cm/sec peak recorded velocity)
N91ED 5 X 18μ (.0002 X .0007 in.) Biradial (Elliptical)	Yellow	5.0 mV	20 to 20,000 Hz	within 2 dB	25 dB at 1 kHz	3/4 to 1½ grams	400 Hz - 22 cm/sec 1,000 Hz - 33 cm/sec 10,000 Hz - 19 cm/sec at 1 gram
N91GD 15 microns (.0006 in.) Spherical	Red	5.0 mV	20 to 20,000 Hz	within 2 dB	25 dB at 1 kHz	3/4 to 1½ grams	400 Hz - 22 cm/sec 1,000 Hz - 33 cm/sec 10,000 Hz - 19 cm/sec at 1 gram

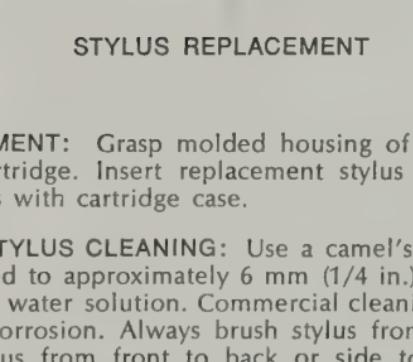
\*Output voltages given for stereo cut record. For MONO cut record, output voltage at both left channel and right channel cartridge terminals will be 71% of figures above.

\*\*Tracking forces greater than maximum indicated should not be used.

NET WEIGHT: .3 grams

FOUR-CHANNEL: These Stereo Dynetic® Styli are compatible with all four-channel matrix systems.

MONOPHONIC OPERATION: Set function switch on amplifier to "MONO" or "A+B." If amplifier is not equipped with this switch, connect left and right channels in parallel.

**STYLUS REPLACEMENT**

**STYLUS REPLACEMENT:** Grasp molded housing of stylus and gently pull forward out of cartridge. Insert replacement stylus into socket and press until housing mates with cartridge case.

**RECOMMENDED STYLUS CLEANING:** Use a camel's hair brush (No. 2 size or smaller), trimmed to approximately 6 mm (1/4 in.), dipped in alcohol or an alcohol-distilled water solution. Commercial cleaning solutions may cause stylus damage or corrosion. Always brush stylus from back to front; never brush or wipe stylus from front to back or side to side.

**TO PRESERVE STYLUS LIFE:**

1. Follow turntable or tone arm instructions when adjusting antiskating force.
2. Do not handle the tone arm while it is in operation since this may cause the arm to sweep across the record.
3. If it is necessary to manually place the tone arm in the record groove while turntable is rotating, release it as soon as the stylus engages the record groove.
4. Correct improper set-down adjustment or malfunction of the turntable changing mechanism to prevent the stylus from striking the edge of the turntable or record. Do not stack more records than turntable manufacturer recommends.
5. Take care to properly insert the stylus into the cartridge assembly and the cartridge and shell assembly into the tone arm receptacle.
6. Use proper vertical tracking force setting for each cartridge.
7. Do not use badly warped, cracked or imperfect records.
8. When dusting the turntable protect the stylus with the stylus guard.

**SPECIAL NOTE:** To maintain the original performance standards of your cartridge, be certain that any replacement stylus you buy bears the following certification on the package: "This Stereo Dynetic® stylus is precision manufactured by Shure Brothers Inc." AVOID INFERIOR IMITATIONS. THEY WILL SERIOUSLY DEGRADE THE PERFORMANCE OF YOUR CARTRIDGE.

ALL GENUINE "DYNETIC®" STYLIS ARE MANUFACTURED BY SHURE BROTHERS INC. LOOK FOR THE NAME SHURE ON THE STYLUS GRIP.

**For more information on your Shure stylus, write for booklet: "A Visit to the Small World of a Stylus."**

**FULL ONE-YEAR WARRANTY:** Shure Brothers Incorporated ("Shure"), 222 Hartrey Avenue, Evanston, Illinois 60204, warrants to the owner of this product that it will be free, in normal use, of any defects in workmanship and materials for a period of one year from date of purchase. You should retain proof of date of purchase. Shure is not liable for any consequential damages. If this Shure product has any defects as described above, carefully repack the unit and return it prepaid to:

Shure Brothers Incorporated

Attention: Service Department

1501 West Shure Drive

Arlington Heights, Illinois 60004

If you are not in the United States, return the unit to your dealer or Authorized Service Center for repair. The unit will be repaired or replaced and returned to you promptly, and if it cannot be repaired or replaced, you may elect to receive a refund. This warranty does not include stylus wear.

**PATENT NOTICE:** Manufactured under one or more of the following U.S. patents: 3,055,988, 3,077,521, 3,077,522, and 3,463,889.

**RECOMMANDATIONS POUR LE NETTOYAGE DE LA POINTE:** Utilisez une brosse douce, à poils de 6 mm. de long, humectée d'alcool pur ou dilué. Les liquides de nettoyage vendus dans le commerce peuvent endommager ou corroder la pointe. Brossez toujours d'arrière en avant.

**POUR PRESERVER LA VIE DE VOTRE DIAMANT:**

1. Réglez la compensation de poussée latérale (antiskating) du bras suivant les instructions du fabricant.
2. Evitez de toucher le bras de pickup pendant le fonctionnement.
3. Si vous devez placer manuellement le bras sur un sillon du disque pendant que la plateau tourne, relâchez le bras dès que la pointe touche le sillon.
4. Réglez la descente du bras pour éviter que la pointe puisse heurter le bord du plateau ou du disque.
5. Evitez d'endommager la pointe lectrice pendant son montage dans le cellule ou le montage de la cellule elle-même.
6. Utilisez une force d'appui convenable.
7. N'utilisez pas de disques très rayés ou endommagés.
8. Protégez la pointe pendant le nettoyage de la platine.

**REMARQUE:** Assurez-vous que tout diamant de remplacement que vous achetez porte la garantie suivante sur son emballage: "This Stereo Dynetic® Stylus is precision manufactured by Shure Brothers Inc." EVITEZ LES IMITATIONS DE QUALITE INFERIEURE. ELLES DETRUIROUENT LE RENDEMENT DE VOTRE CELLULE. CHERCHEZ LE NOM DE SHURE SUR LE SUPPORT DE POINTE EN PLASTIQUE. Pour de plus amples renseignements sur les pointes de lecture Shure, écrivez demander la brochure "Visite au Petit Monde d'une Pointe de Lecture."

**GARANTIE TOTALE D'UN AN:** Shure Brothers Incorporated ("Shure"), 222 Hartrey Avenue, Evanston, Illinois 60204, garantit ce produit à son propriétaire, en utilisation normale, contre tous défauts de fabrication ou de matériaux, pendant une période d'un an à partir de la date d'achat. Conservez votre preuve d'achat. Shure n'est responsable d'aucuns dommages indirects. Si ce produit Shure présente un défaut comme précisé ci-dessus, remballez-le soigneusement et renvoyez-le en port payé à l'adresse ci-dessus. Si vous n'êtes pas aux U.S.A., renvoyez-le à votre revendeur ou au représentant officiel Shure, pour réparation. Ce produit sera réparé ou remplacé rapidement. S'il ne peut être réparé ou remplacé, vous pouvez opter pour un remboursement. Cette garantie ne couvre pas l'usure des pointes de lecture.

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**REINIGUNG DES ABTASTSTIFTES:** Zur Reinigung des Abtaststiftes wird eine Kamelhaarbüste empfohlen (Borstenlänge ca. 6 mm), die vorher in Alkohol oder Spiritus getaucht wurde. Handelsübliche Reinigungsmittel können Korrosion verursachen oder sogar zur Zerstörung des Abtaststifteinschubs führen. Die Bürste stets von hinten nach vorne bewegen.

**HINWEIS ZUR ERHÖHUNG DER LEBENSDAUER DES ABTASTSTIFTES:**

1. Antiskating-Einstellung nach Herstellerangaben justieren.
2. Bei Automatik-Plattenspielern sollte der Tonarm während des Betriebes niemals berührt werden.
3. Muß der Tonarm manuell, also von Hand geführt werden, sollte er so vorsichtig wie möglich auf die Platte aufgesetzt werden.
4. Achten Sie beim Aufsetzen des Tonarms darauf, daß der Abtaststift nie den Plattenteller oder die Kante der Schallplatte berührt.
5. Besondere Sorgfalt ist beim Einsetzen des System-Einschubs und des Systems geboten.
6. Kontrollieren Sie von Zeit zu Zeit die Auflagekraft des Tonarms.
7. Keine stark abgenutzten, gewellten oder zerkratzten Platten abspielen.
8. Beim Reinigen des Plattenspielers den Abtaststift vorsorglich durch Herunterklappen des Visiers vor Beschädigung schützen.

**BESONDERER HINWEIS:** Um die gewohnt gute Wiedergabe Ihres Systems nicht zu vermindern, sollten Sie bei der Nachbestückung des System-Einschubs unbedingt auf einen Original SHURE-Abtaststift bestehen. Achten Sie auf die Aufschrift "This Stereo Dynetic® Stylus is precision manufactured by Shure Brothers Inc." auf der Verpackung. LEHNEN SIE MINDERWERTIGE IMITATIONEN AB! ERHEBLICHE KLANGMINDERUNG ODER BESCHÄDIGUNG DER SCHALLPLATTEN KÖNNEN DIE FOLGE SEIN. ACHTEN SIE AUF DEN NAMEN SHURE AN DEM KUNSTOFFTEIL DES SYSTEM-EINSCHUBS. Fordern Sie die kostenlose Broschüre "Ausflug in die Mikrowelt eines System-Einschubs" an.

**UNBESCHRÄNKTE EINJÄHRIGE GARANTIE:** Shure Brothers Incorporated ("Shure"), 222 Hartrey Avenue, Evanston, Illinois 60204, garantiert dem Besitzer dieses Produktes, dass es für die Dauer von ein Jahr, beginnend mit dem Kaufdatum, frei von Material- und Fertigungsfehlern ist. Aus diesem Grunde bitte die Rechnung mit Kaufdatum aufbewahren. Shure übernimmt keine Haftung für Folgeschäden. Sollte dieses Shure Produkt einen der oben beschriebenen Fehler aufweisen, schicken Sie bitte den Gegenstand ausreichend frankiert an obige Anschrift. Wenn Sie nicht in den U.S.A. leben, schicken Sie den Gegenstand an Ihren Händler oder an eine autorisierte Kundendienststelle zur Reparatur. Das beanstandete Produkt wird repariert oder ersetzt und an Sie zurückgesandt. Ist Reparatur oder Ersatz nicht möglich, erfolgt eine Rückerstattung. Diese Garantie gilt nicht für die Abnutzung des Abtaststiftes.

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**RECOMENDACIONES PARA LIMPIAR LA AGUJA (PÚA):** Usar un pincel de pelo de camello de 6 mm. de largo, humedecido en alcohol etílico o en una mezcla de alcohol y agua. Evitar el uso de líquidos que se venden en los comercios para la limpieza de agujas y discos. Pueden dañar o corroer la aguja. Siempre limpiar la aguja de atrás hacia adelante.

**PARA CONSERVAR EL USO DE LA AGUJA:**

1. Ajustar la fuerza antipatinadora de acuerdo con las instrucciones del fabricante.
2. Evitar mover el brazo cuando esté funcionando.
3. Si es necesario manipular el brazo en el surco del disco mientras la tornamesa gira, soltarlo tan pronto la aguja haga contacto con el surco.
4. Ajustar el mecanismo del brazo para evitar que la aguja choque con el borde del disco o tornamesa.
5. Evitar dañar la aguja cuando se instale la cápsula o se reemplace la aguja.
6. Usar la fuerza de apoyo debida.
7. No usar discos que estén rajados, doblados o con imperfecciones.
8. Proteger la aguja con su visera cuando se limpia el tornamesa.

**NOTA ESPECIAL:** Para que la calidad original de la cápsula se conserve, asegurarse al comprar una nueva aguja que ésta lleve la siguiente certificación en su estuche: "This Stereo Dynetic® Stylus is precision manufactured by Shure Brothers Inc." EVITE IMITACIONES, PUEDEN REDUCIR SERIAMENTE LA CALIDAD DE LA CÁPSULA. TODAS LAS AGUJAS "DYNAMIC" AUTÉNTICAS ESTÁN FABRICADAS POR SHURE BROTHERS INC. BUSQUE POR EL NOMBRE SHURE EN EL MANGO DE LA AGUJA. Para más información sobre su aguja Shure, favor de pedirnos el panfleto "Visita al Pequeño Mundo de la Aguja."

**UN AÑO COMPLETO DE GARANTÍA:** Shure Brothers Incorporated ("Shure"), 222 Hartrey Avenue, Evanston, Illinois, 60204, garantiza al dueño de este producto que este mismo está libre de cualquier defecto, durante uso normal, en materiales y labor por un periodo de un año desde su adquisición. Shure no es responsable por daños que resulten por otras consecuencias. Si este producto es defectuoso en alguna manera, empáquelo cuidadosamente y devuélvalo a la dirección de arriba. Si Ud. reside fuera de los E.E.U.U., devuelva el producto al lugar de compra o Centro de Servicio Autorizado para su reparación. El producto será reparado o reemplazado y devuelto a Ud. prontamente, y si no puede ser reparado o reemplazado, Ud. puede elegir una devolución del importe de su compra. Esta garantía no incluye el degaste normal de la aguja (púa).

the cartridge and shell assembly into the tone arm receptacle.

6. Use proper vertical tracking force setting for each cartridge.
7. Do not use badly warped, cracked or imperfect records.
8. When dusting the turntable protect the stylus with the stylus guard.

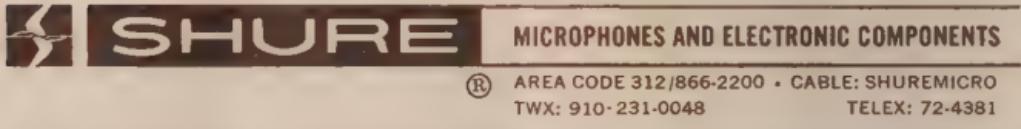
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Shure Brothers Incorporated

ATTN: Service Department

222 HARTREY AVE., EVANSTON, IL. 60204 U.S.A.



## THE PREMIER FAMILY OF STEREO SOUND REPRODUCERS

### MODELS N91GD AND N91ED

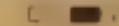
### STEREO DYNETIC® PHONOGRAPH STYLI FOR MODELS M91ED, M91GD AND DUAL MODEL DM101MG AND DM103ME CARTRIDGES

#### STYLI SPECIFICATIONS

Replacement Stylus	Stylus Grip Color	Output (1 kHz at 5 cm/sec peak recorded velocity)*	Frequency Response	Channel Balance	Channel Separation (minimum)	Tracking Force**	Trackability (cm/sec peak recorded velocity)
N91ED 5 X 18 $\mu$ .0002 X .0007 in.) Biradial (Elliptical)	Yellow	5.0 mV	20 to 20,000 Hz	within 2 dB	25 dB at 1 kHz	3/4 to 1 1/2 grams	400 Hz - 22 cm/sec 1,000 Hz - 33 cm/sec 10,000 Hz - 19 cm/sec at 1 gram
N91GD 15 microns	Red	5.0 mV	20 to 20,000	within 2 dB	25 dB at 1 kHz	3/4 to 1 1/2 grams	400 Hz - 22 cm/sec 1,000 Hz - 33 cm/sec 10,000 Hz - 19 cm/sec at 1 gram

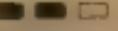
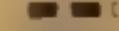
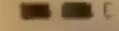
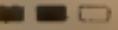
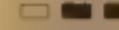
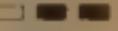
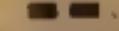
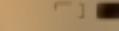
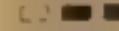
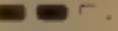
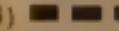
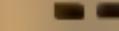
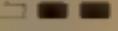
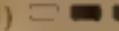
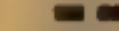
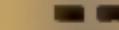
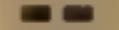
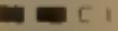
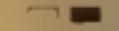
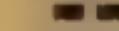
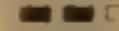
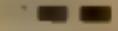
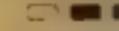
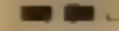
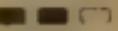
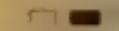
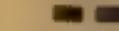
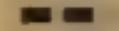
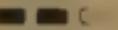
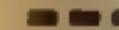
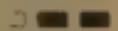
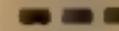
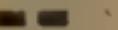
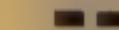
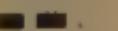
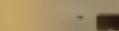
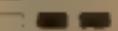
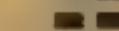
# ACOUSTICAL QUAD 22

# RECORD EQUALISATION GUIDE

FOR ALL MAKES OF LP AND 45 RECORDS ISSUED SINCE 1954 USE 

FOR ALL MAKES OF 78 RECORDS ISSUED SINCE 1954 USE 

THE FOLLOWING EQUALISATIONS SHOULD GIVE THE BEST PERFORMANCE FROM RECORDS ISSUED BEFORE 1954  
EXCEPTIONS OCCUR, PARTICULARLY WHEN RECORDS ARE MADE FROM SHARED MASTERS THIS CHART SHOULD  
THEREFORE BE USED AS A GUIDE ONLY WHEN IN DOUBT USE  FOR ALL PRE-1954 RECORDS

ALLEGRO		CETRA-SORIA		EPIC		PERIOD	
ALLIED		COLOSSEUM		ESOTERIC		PHILHARMONIA	
AMERI'N REC SOC		COLUMBIA		FELSTED		PHILIPS	
ANGEL		COLUMBIA UK (78)		HANDEL SOC		POLYMUSIC	
ARCHIV		COLUMBIA US (78)		HAYDN SOC		RACHM'N'OFF SOC	
ARGO		CONCERT HALL		H M V		R C A	
ATLANTIC		COOK		H M V (78)		REMINGTON	
AUDIOPHILE		CORAL		LONDON		RENAISSANCE	
BACH GUILD		DECCA UK		LYRICHORD		STRADIVARI	
BANNER		DECCA UK (78)		MERCURY		SWING	
BARTOK		DECCA US		M G M		TELEFUNKEN	
BRUNSWICK		DGG		NIXA		TELEFUNKEN (78)	
BRUNSWICK (78)		DGG (78)		OCEANIC		TEMPO	
CAEDMON		DIAL		OISEAU-LYRE		URANIA	
CAPITOL		DURIUM		OXFORD		VANGUARD	
CAPITOL (78)		ELEKTRA		PARLOPHONE		VOX	
CAPITOL-SORIA		E M S		PARLOPHONE (78)		WESTMINSTER	

— PRESSSED



— RELAXED

— DISCS —

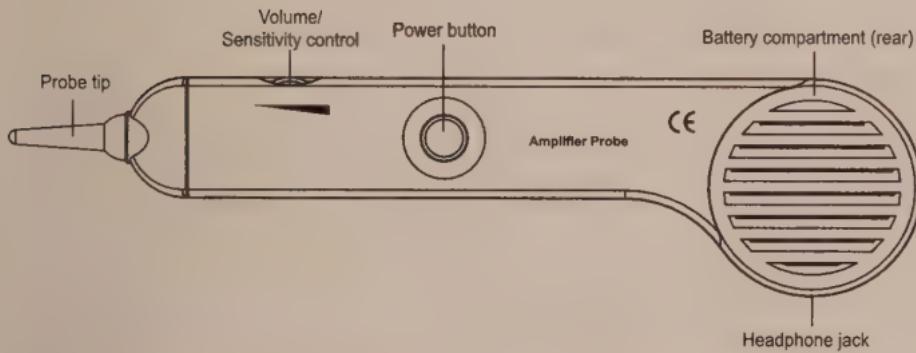
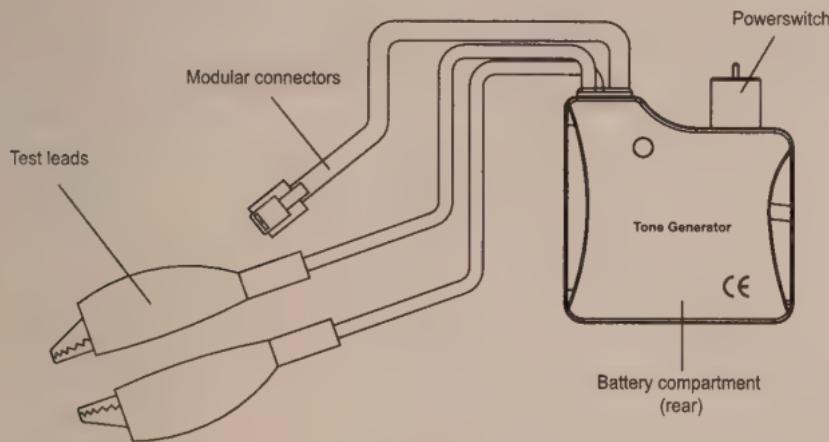


# Tone Generator and Amplifier Probe

## Specifications

Power: 9V battery (tone generator and probe (1 each))

Tone output : 1kHz, 6V square wave (approximately)



Dimensions Probe: 9x2.25x1(228x57x25.4mm)

Generator: 2.3x2.3x1.35"(58.5x58.5x34.3mm)

Weight : 0.6lb (270gm)

# **Operating Instructions**

## **Cable/Wire tracing**

1. Connect the tone generator to the cable
  - a) For cables terminated at one end, connect the red alligator clip to a wire and the black alligator clip to equipment ground
  - b) For unterminated cables, connect the red alligator clip to one wire and the black alligator clip to another wire.
  - c) For cables with modular connectors, plug the RJ11 connectors directly into the matching cable connectors.
2. Set the tone generator power switch to the TONE position.
3. On the amplifier probe, press and hold the side on/off switch.
4. Hold the insulated probe tip against the wire in question to pick up the signal generated by the tone generator.
5. Rotate the volume/sensitivity control on the top of the probe for the appropriate level and sensitivity to identify and trace the wire.
6. The tone will be the loudest on the wires connected to the tone generator.

**Note:** A headphone jack is located on the bottom of the probe.

## **Identifying telephone cable Tip and Ring – Using Alligator Clips**

1. Switch the tone generator to the OFF position
2. Connect the red test lead to one line and the black lead to the other line.
3. The LED color indicates the connection to the RED test lead as:  
GREEN = Ring side, RED = Tip side.

## **Identifying telephone cable Tip and Ring – Using the RJ-11 Connectors**

1. Switch the tone generator to the OFF position
2. Connect the RJ-11 connector mating cable connector.
3. The LED color indicates the condition of the telephone jack wiring.  
GREEN = Jack wired properly, RED = Jack wired with reversed polarity.

## **Identifying telephone cable Line Condition**

1. Switch the tone generator to the OFF position
2. Connect the red test lead to the RING side and the black test lead to the TIP side.
3. The LED will indicate line condition by:  
GREEN = CLEAR , OFF = BUSY, Flickering YELLOW = RINGING
4. Switch the tone generator power switch to CONT to terminate the call.

## **Continuity testing**

1. Connect the test leads to the wire pair under test.
2. Switch the tone generator to the CONT position.
3. The LED will glow bright GREEN for a low resistance or continuity.  
The LED will glow less brightly as the resistance increases and will extinguish at approximately 10,000ohms.

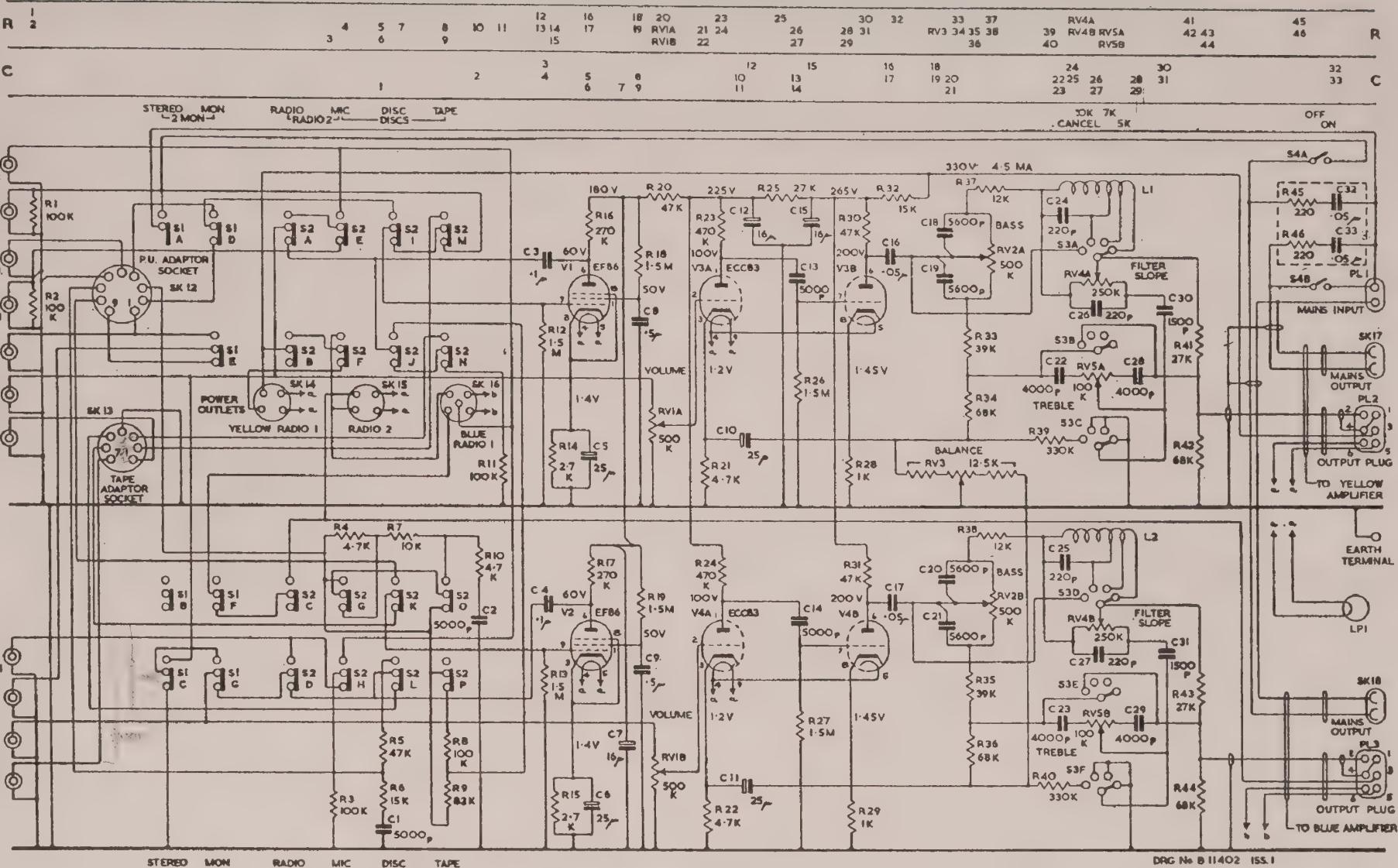
## **Tone selection**

The output of the tone generator can be set to continuous or wobble.

To change the type of output, change the tone type switch position (located in the battery compartment)

## **Battery replacement**

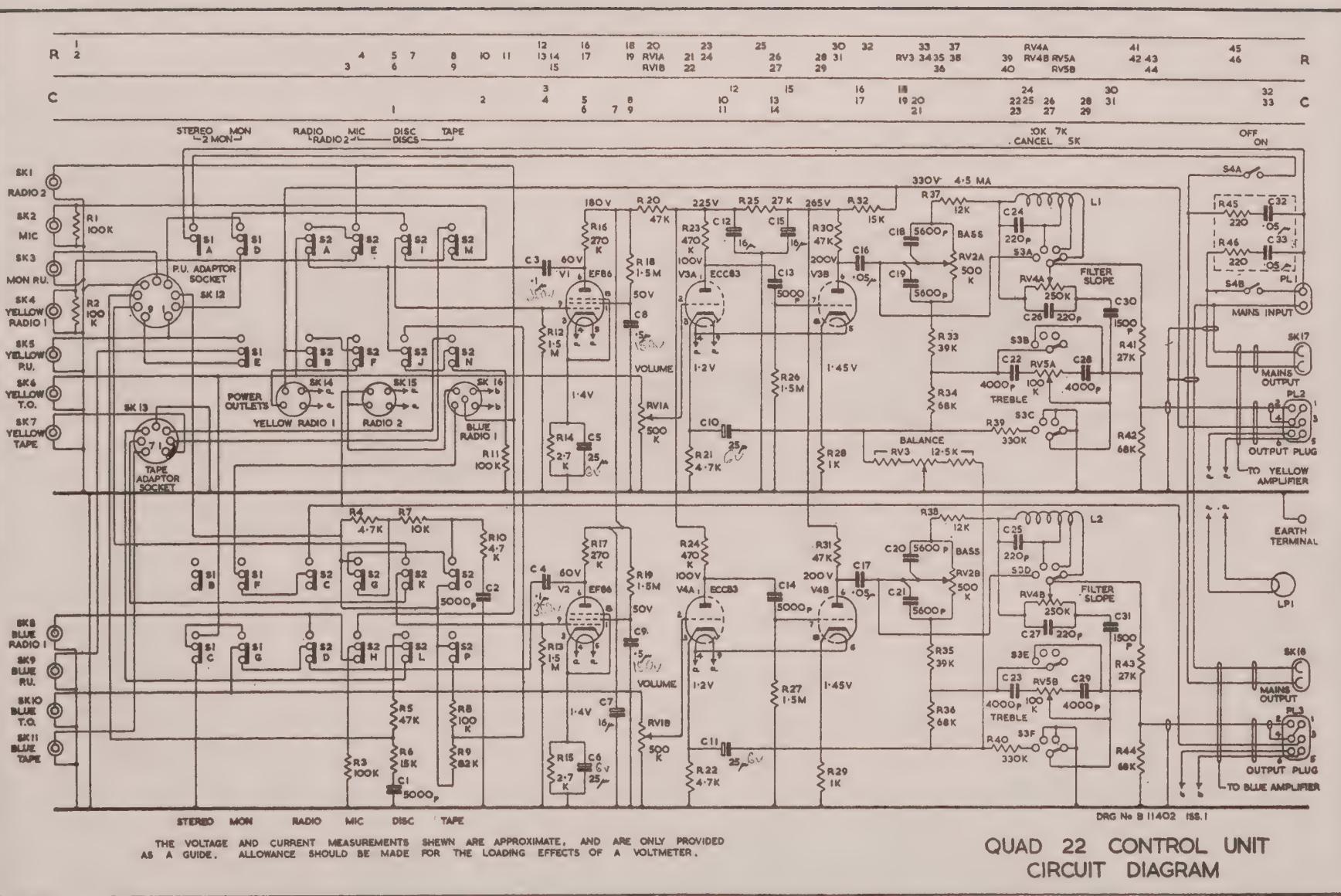
Install a new battery by removing the battery cover as indicated in the meter description diagram.



THE VOLTAGE AND CURRENT MEASUREMENTS SHewn ARE APPROXIMATE, AND ARE ONLY PROVIDED AS A GUIDE. ALLOWANCE SHOULD BE MADE FOR THE LOADING EFFECTS OF A VOLTMETER.

**QUAD 22 CONTROL UNIT  
CIRCUIT DIAGRAM**





THE VOLTAGE AND CURRENT MEASUREMENTS SHewn ARE APPROXIMATE, AND ARE ONLY PROVIDED AS A GUIDE. ALLOWANCE SHOULD BE MADE FOR THE LOADING EFFECTS OF A VOLTMETER.

**QUAD 22 CONTROL UNIT  
CIRCUIT DIAGRAM**

Amendment December, 1959

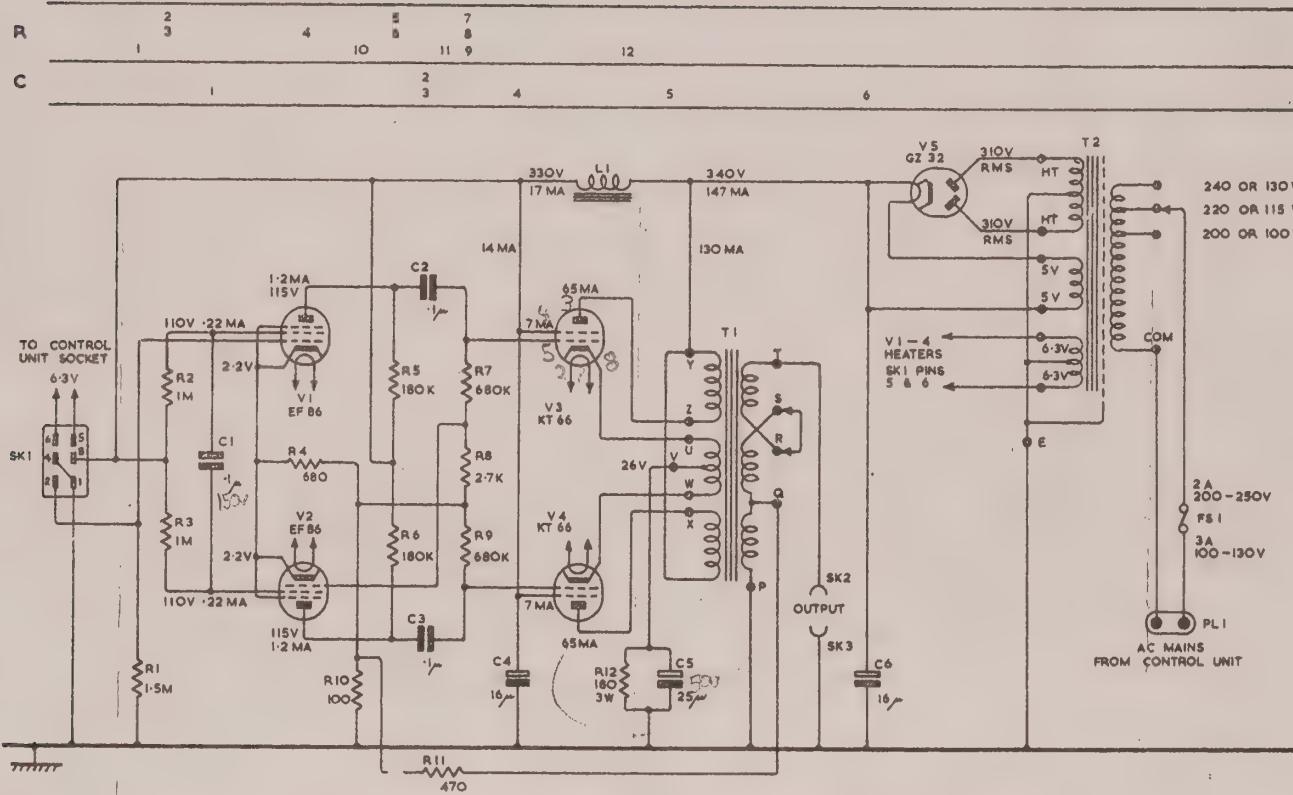
C 13 } now 820 pF (Q).  
C 14 }

C 16 } now .1 uF 250V  
C 17 }

C 34 } C 35 } added .02 uF in series with volume control. 150v



**QUAD II POWER AMPLIFIER**



British American

GZ-32  
SV4

KT66  
GL6GC  
EF86  
G267



**AMERITRON ARB-702I**

**INTERFACE RELAY  
BUFFER**

**INSTRUCTION MANUAL**

**PLEASE READ THIS MANUAL BEFORE OPERATING THIS EQUIPMENT !**

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**AMERITRON**

116 Willow Road  
Starkville, MS 39759 USA  
601-323-8211<sup>1</sup>

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# Ameritron ARB-702I

## Instruction Manual

### INTRODUCTION

The ARB-702 serves the same function as the isolation relay recommended by many transceiver manufacturers, but has no moving parts to wear out or reduce T/R switching speed. The ARB-702 places less stress on the radio than the smallest isolation relay.

The ARB-702, when properly installed, fully protects radios from damage caused by keying line transients or excessive current and voltage. Any transceiver that provides an external power amplifier control line may be used to control any amplifier having a positive relay control voltage under 200 volts and 200 mA when the ARB-702 is used. The ARB-702 fully protects transceivers like the Icom 706 from excessive control line voltage or current, and even allows a simple and safe interface to rigs like Ten-Tec's that source a positive amplifier control voltage.

### TECHNICAL DESCRIPTION

The ARB-702 draws only 1 mA per volt from a radio keying line that goes high (common in Ten-Tec's). If the keying line goes to 12 volts, the ARB-702 will draw 12 mA from the radio. Any radio pulling the control line low will have less than 2 mA of current. The open circuit voltage applied to the radio can be set by the user to any voltage between 3 and 30 volts.

The output will pull a 100 mA relay line to within 0.2 volts of ground, and is capable of handling 200 volts of positive open circuit voltage.

### INSTALLATION

*If your radio has a control line that pulls low:*

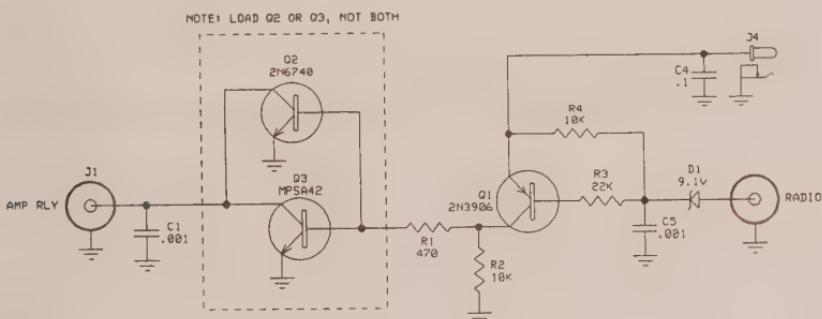
- 1.) Connect the center pin of the jack marked "RADIO" to the radio's amplifier control line. Connect the shell of the "RADIO" jack to the radio's common control line connection or ground.
- 2.) Connect the center pin of the "POWER" jack to a positive supply voltage. This voltage must be *more than 3 volts but less than 30 volts for the maximum safe voltage for the radio*. You can find the voltage rating in the radio's manual, or ask the radio's manufacturer what the safe control line voltage is. In nearly all cases, 5-12 volts will be completely safe.
- 3.) Connect the center pin of the jack marked "AMP Relay" to the amplifiers relay control jack. Do not exceed 200 volts or 200mA on this jack, and not apply AC or negative voltage. Connect the shell of this jack to the amplifier's relay control line ground.

**If your radio has a control line that goes high to activate the amplifier:**

- 1.) Connect the center pin of the jack marked "RADIO" directly to the shell of the "RADIO" jack.
- 2.) Connect the center pin of the "POWER" jack to the radio's positive control voltage. This voltage must be *more than 3 volts* but *less than 30 volts*.
- 3.) Connect the center pin of the jack marked "AMP Relay" to the amplifier's relay control jack. Connect the shell of this jack to the amplifiers relay control line ground.

**WARNING: DO NOT EXCEED 200 VOLTS OR 200 MA ON AMP RELAY JACK, AND DO NOT APPLY AC OR NEGATIVE VOLTAGE.**

## SCHEMATIC



For Icom 706 & Mark II	ARB-702I
Pin 3	Radio center
Pin 2	Radio shield
Pin 8	Red lead of power jack



116 Willow Road  
Starkville, MS 39762

### LIMITED WARRANTY

Ameritron warrants to the original purchaser that this product shall be free from defects in material (except tubes and RF output transistors) or workmanship for one year from the date of original purchase.

During the warranty period, Ameritron or an authorized Ameritron service facility will provide free of charge both parts (except tubes and RF output transistors) and labor necessary to correct defects in material or workmanship.

**To obtain such warranty service, the original purchaser must:**

- (1) Complete and send in the Warranty Registration Card.
- (2) Notify Ameritron or its nearest authorized service facility, as soon as possible after discovery of a possible defect, of:
  - (a) The model number and serial number, if any;
  - (b) The identity of the seller and the approximate date of purchase;
  - (c) A detailed description of the problem, including details on the equipment.
- (3) Deliver the product to the Ameritron or the nearest authorized service facility, or ship the same in its original container or equivalent, fully insured and shipping charges prepaid. Correct maintenance, repair and use are important to obtain proper performance from this product. Therefore, carefully read the Instruction Manual. This warranty does not apply to any defect that Ameritron determines is due to:
  - (1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts.
  - (2) Misuse, abuse, neglect or improper installation.
  - (3) Accidental or intentional damage.

**All implied warranties, if any, terminate one (1) year from the date of the original purchase.**

The foregoing constitutes Ameritron's entire obligation with respect to this product, and the original purchaser and any user or owner shall have no remedy and no claim for incidental or consequential damages. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damage, so the above limitation and exclusion may not apply to you.

This warranty gives specific legal rights and you may also have other rights which vary from state to state.

installation and  
operating instructions  
for model SX-71  
**NBFM and AM**  
radio receiver



MARCH 1950

94X387

**the hallicrafters co.**

MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 24, U. S. A.

# INSTALLATION AND OPERATING INSTRUCTIONS RADIO RECEIVER MODEL SX-71



FIG. 1. Radio Receiver Model SX-71

## DESCRIPTION

The Model SX-71 radio receiver is a sensitive communications type superheterodyne receiver covering the 160, 80, 40, 20, 10 and 6 meter amateur bands in its frequency range of 560 kilocycles (KC) to 56 megacycles (MC). The receiver is designed for reception of CW (Code) signals, narrow band frequency modulated (NBFM) signals and amplitude modulated (AM) broadcasts over its entire frequency range as follows:

### FREQUENCY COVERAGE

Band	# Frequency Range	Type of Reception
1	560 KC - 1600 KC	AM/NBFM/CW
2	1650 KC - 4700 KC	AM/NBFM/CW
3	4.7 MC - 13.4 MC	AM/NBFM/CW
4	12.8 MC - 34 MC	AM/NBFM/CW
5	46 MC - 56 MC	AM/NBFM/CW

AM - Amplitude Modulation

CW - Code

NBFM - Narrow Band Frequency Modulation

# First and last dial calibration

For maximum ease and flexibility of operation, two extra-wide slide-rule dials calibrated directly in frequency of reception are used. One provides for general coverage over the frequency range 560 KC to 34 MC, and the other is a bandspread dial calibrated specifically for the 80, 40, 20, 10 and 6 meter amateur bands.

The use of a double conversion circuit, improves selectivity and provides better image rejection than in the conventional superheterodyne receiver.

For the ultimate in selectivity, a variable crystal filter and a crystal phasing control are used so that the receiver can be peak adjusted for that hard-to-read signal.

The audio system provides sufficient audio power to operate either headphones or speaker. A phono jack permits operation of the audio amplifier as a separate unit.

An automatic noise limiter operated by a toggle switch, permits the operator to reduce the background noise caused by severe electrical disturbances.

A RECEIVE-STANDBY switch permits receiver disabling for short standby periods without having to wait for the tube heaters to reach operating temperature when reception is again required.

The receiver normally operates from a 105-125 volt 50/60 cycle alternating current (AC) source. A connector for operating the receiver with external batteries or equivalent power is provided to permit operation in areas where AC current does not exist. A universal model of the SX-71 receiver permits operation from 25/60 cycle alternating current sources and at voltages ranging from 105 to 250 volts. The power requirements for your receiver must be checked carefully. Read over the installation section of this book and check the labels on the receiver before connecting to your power source.

## INSTALLATION

**UNPACKING** - Check all shipping instruction tags carefully before removing them.

**LOCATION** - The receiver is equipped with rubber feet for table top or shelf mounting. It is important that the receiver have proper ventilation because overheating may cause excessive frequency drift. Therefore, avoid placing the receiver in excessively warm locations such as near radiators, hot air registers, or confined dead air spaces such as are encountered in recessed installations. Note also that the top cover of the receiver is made of perforated metal to provide proper ventilation of the chassis. Do not block free circulation of air by placing loudspeaker, log book, clocks, etc. on this cover.

This receiver has an extremely high degree of IF selectivity. For this reason it is best to locate the loudspeaker 12" to 18" from the receiver to avoid the possibility of acoustical or mechanical coupling between the two, a condition which would be evidenced by howl or feedback at the higher volume levels.

**POWER SOURCE** - Two types of power sources may be used to operate the receiver. The receiver may be operated directly from an AC source or indirectly from a battery or DC source as follows:

**AC Operation** - The receiver, as normally supplied, operates from a 105 to 125 volt, 50/60 cycle AC outlet. Power consumption is approximately 90 watts. If you are in doubt or unfamiliar with the voltage and frequency rating of your utility service, consult your local power company representative. Attempting to operate the receiver from other sources of power than specified may involve costly repairs.

A universal model is available for operation from 115 V./130 V./150 V./220 V./250 V. 25/60 cycle AC sources. A selector switch on the power transformer permits operation on any of the line voltages shown.

**CAUTION** - When operating the universal model, it is essential to check, and if necessary, to set the selector switch on the power transformer before connecting the receiver to the source of power.

**Note** - The receiver will not operate from an AC source unless the jumper plug is inserted in its BATTERY POWER receptacle. (See Fig. 3.).

**DC Operation** - The receiver may be operated from a 6-volt DC source (storage battery or equal) and a 270-volt DC supply in the form of "B" batteries, vibrator power pack, or motor generator set. The DC source must be capable of supplying the following voltages and currents for optimum results.

"B" voltage .....	270 Volts
"B" current .....	.110 Milliamperes
Heater voltage .....	6.3 Volts
Heater current .....	4.4 Amperes

Total current drain, when operating entirely from a storage battery (Vibrator type supply), will run approximately 15 amperes.

DC power is connected to the receiver through the octal socket located on the rear apron of the chassis. The jumper plug normally in this socket for AC operation is replaced with a standard octal plug for DC operation.

Wire the octal plug for DC operation as shown in Fig. 2.

## VIBRAPACK

## BATTERIES

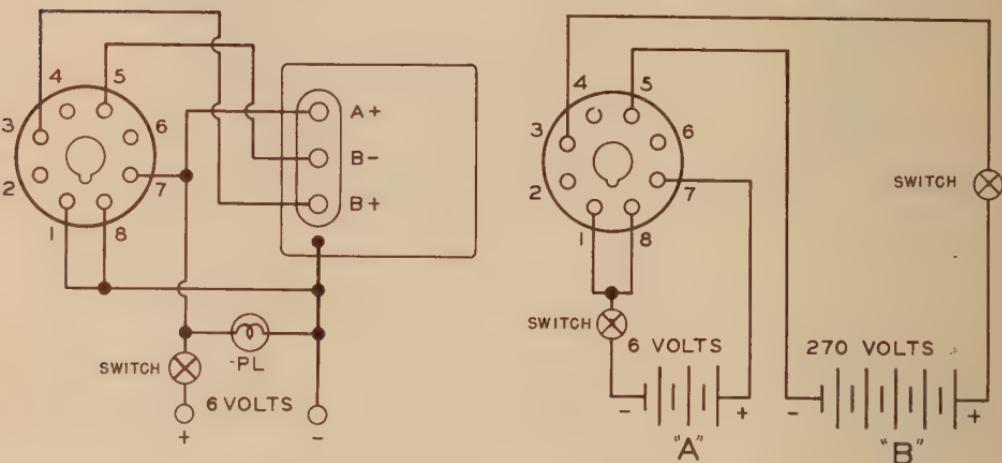


Fig. 2. Wiring diagram, DC power plug.

928520

**SPEAKER CONNECTION** - Three screw type terminals, located on the rear chassis apron, are provided for the speaker connections. The output impedances available are 3.2 and 500 ohms. Any suitable speaker unit which will operate with either of these output impedances may be used with the Model SX-71 receiver. Hallicrafters Model R-42 and R-44 speaker units connect to the 500 ohm terminals (Marked "G/500").

**ANTENNA** - A three terminal strip marked "A1", "A2" and "G" is located at the rear chassis apron for antenna connections. This terminal arrangement will accomodate either a single wire antenna lead-in or an antenna transmission line.

**Single Wire Antenna** - For a single wire antenna installation, connect a jumper between the antenna terminals "A2" and "G". A single wire antenna about 50 to 100 feet long (including lead-in) is then connected to terminal "A1". Erect the antenna as high and free from surrounding objects as possible. This type of antenna must be well insulated from ground for best results. It may be desirable in some installations to connect a ground wire between terminal "G" and a suitable ground such as a water pipe or outside ground stake.

**Doublet Antenna** - The doublet antenna is recommended for the high frequency bands, especially where a maximum signal to noise level is required over a relatively narrow range of frequencies. The antenna transmission line is connected to terminals "A1" and "A2". If a concentric line with a grounded outer conductor is used, connect the inner conductor to terminal "A1" and outer conductor to terminal "A2", and connect a jumper wire between terminals "A2" and "G".

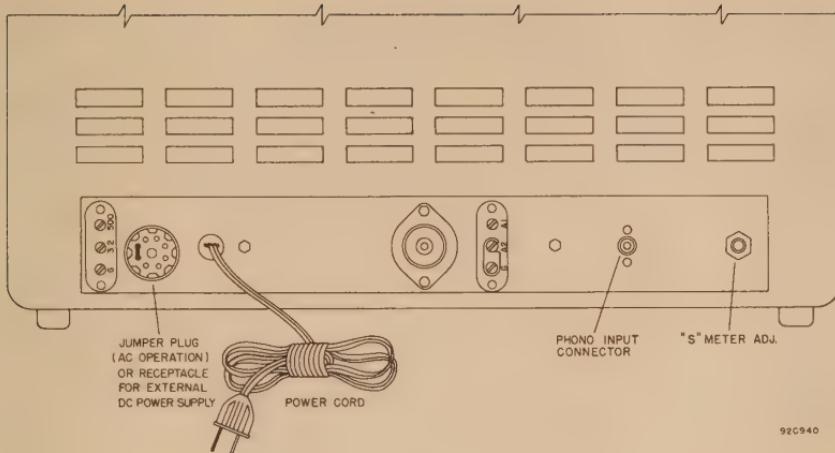
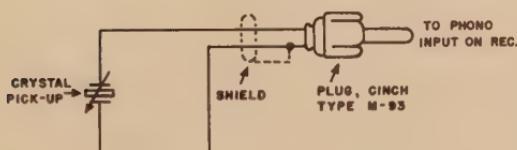
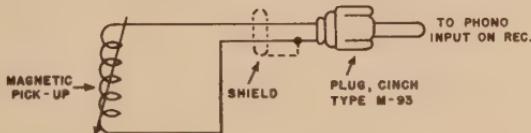


Fig. 3. Rear view.

The overall length (feet) of a doublet antenna may be determined by dividing the constant 468 by the desired frequency in megacycles. Keep in mind that this type of antenna is directional broadside to its length and should be so oriented if maximum pickup from a given direction is desired.

This receiver will work satisfactorily with antennas terminating in impedances ranging from 50 to 600 ohms. However, best performance will be obtained when a 300-ohm antenna is employed. Since every installation is an individual problem, it is impossible for us to make specific antenna recommendations. However, an excellent source of information on the various types of antennas and problems relating to antenna installation is the American Radio Relay League (West Hartford, Conn.) Radio Amateur's Handbook.

**RECORD PLAYER CONNECTION** - A shielded type receptacle is provided at the rear chassis apron to accommodate a record player pickup cable connector. Any record player employing a crystal cartridge or high level magnetic pickup in its tone arm may be used with the receiver. Refer to Fig. 4 for wiring details.



928 522

Fig. 4. Wiring diagram, record player connection.

**REMOTE STANDBY SWITCH CONNECTIONS** - The receiver may be disabled remotely by connecting a remote switch between pins #4 and #1 of the jumper plug (Fig. 3). To operate the receiver remotely, set the RECEIVE-STANDBY switch on the receiver panel at STANDBY and close the remote switch to put the receiver in operation. Pin #2 of the jumper plug is connected to the free terminal of the SPDT standby switch, (the arm of the switch is grounded in the receiver) and may be used to operate a transmitter relay circuit from the panel of the receiver. In the STANDBY position pin #2 is grounded; in the RECEIVE position pin #2 is insulated from ground.

## OPERATION

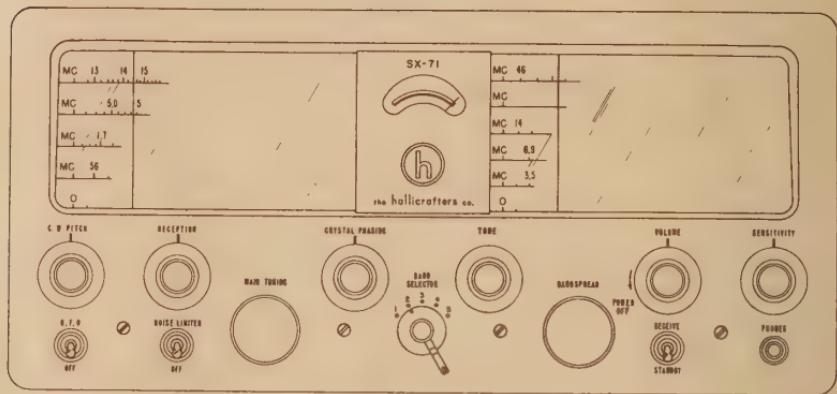


Fig. 5. Front view, location of controls.

**RADIO TELEPHONE RECEPTION** - To receive amplitude modulated (AM) or narrow band frequency modulated (NBFM) radio telephone signals, the following use of the controls is recommended to obtain maximum performance from the MODEL SX-71 receiver.

**VOLUME control -**

This control turns the receiver on and off in addition to controlling the volume. Turn the control clockwise to turn on the receiver or increase volume and counter-clockwise to reduce volume. To turn off the receiver, turn the control completely to the left.

**RECEIVE/STANDBY switch -**

Normally set at RECEIVE. May be set at STANDBY to disable the receiver for short standby periods and yet keep the tube heaters at operating temperature for instant use.

**B.F.O. switch -**

For radio phone reception, this control is set at OFF.

**RECEPTION control -**

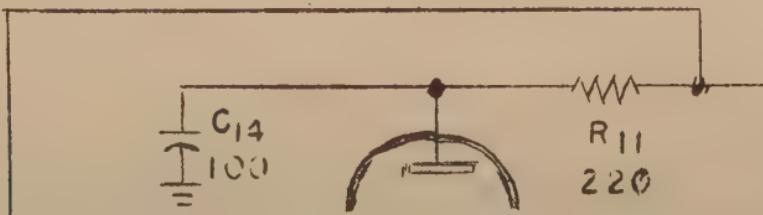
Set at N.B.F.M. for the reception of narrow band frequency modulated radio telephone stations located in any of the short wave bands. To receive amplitude modulated radio telephone signals over any portion of the frequency range, three positions of the RECEPTION control may be used; these are, NORMAL I.F., BROAD CRYSTAL, and SHARP CRYSTAL. The individual settings will be determined by the degree of selectivity desired; the broadest bandwidth is under NORMAL I.F. and the narrowest, under SHARP CRYSTAL. The use of the crystal filter will require an adjustment of the CRYSTAL PHASING control. Refer to "USE OF CRYSTAL PHASING CONTROL" for details.

ERRATA SHEET FOR SX-71

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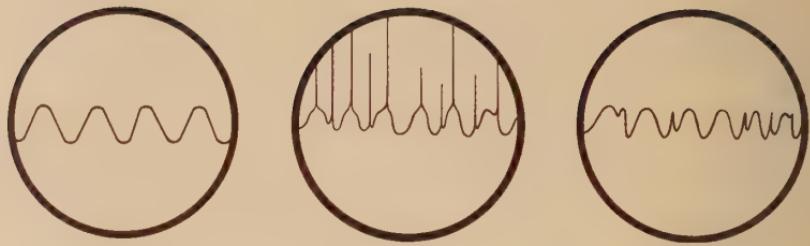
The following changes, distinguish Run #3 from Run #2.

1. The red lead from T-7 is connected directly to T-6.
2. R-52 has a value of 100,000 ohms.
3. R-22 has a value of 1000 ohms.
4. Change the plate circuit of V 3 as shown below.





BAND SELECTOR - control -	Set for the desired position as indicated by the band number on the dial scale. Bands 1 through 4 are to be found on the left hand tuning dial and band 5 is on the right hand dial.
MAIN TUNING control -	Sets the frequency of reception on bands 1 through 4 after the individual band has been selected by the BAND SELECTOR. Frequency of all bands are shown in megacycles (MC).
BANDSPREAD control -	Sets the frequency of reception on band 5 after that band has been selected by the BAND SELECTOR switch. More specifically however, this control functions to spread out the amateur bands. If the MAIN TUNING control is indexed for any of the amateur bands as indicated by the markings on the left hand dial, the BANDSPREAD control may be used to set the frequency of reception accurately within the band itself.
SENSITIVITY control -	Normally set maximum clockwise. The control must be set maximum clockwise for correct "S" meter operation.
TONE control -	Set at 0 for normal response. Turn in a clockwise direction to increase the bass response and attenuate the high frequency audio response.
NOISE LIMITER Switch -	Normally set at "OFF". Where natural or "man-made" static interferes with reception this switch may be set at NOISE LIMITER to reduce the interference. See Fig. 6.
CW (Code) RECEPTION -	To receive code transmissions the following use of the receiver controls is recommended:
B.F.O. switch -	Set at B.F.O. for CW reception.
C.W. PITCH control	- After the code signal has been tuned in, this control can be adjusted to the tone pitch that is most pleasing to the ear of the operator.
VOLUME control -	Same as for RADIO TELEPHONE RECEPTION.
RECEIVE/STANDBY switch -	Same as for RADIO TELEPHONE RECEPTION
BAND SELECTOR control -	Same as for RADIO TELEPHONE RECEPTION.
MAIN TUNING control -	Same as for RADIO TELEPHONE RECEPTION.
BANDSPREAD control -	Same as for RADIO TELEPHONE RECEPTION
RECEPTION control -	Set for NORMAL I.F. If a greater selectivity is desired, this control should be set for BROAD CRYSTAL or SHARP CRYSTAL. The use of the crystal filter will require an adjustment of the CRYSTAL PHASING control. Refer to "USE OF CRYSTAL PHASING CONTROL" for details.
TONE control -	Set at 0 for code reception
SENSITIVITY control -	The receiver sensitivity must be controlled manually for code reception, hence the SENSITIVITY control must be advanced just enough to keep the code stations from blocking the receiver.
NOISE LIMITER switch -	The noise limiter circuit is particularly useful for code reception because it "clips" the intermittent noise peaks down to the level of the desired signal where they tend to become unnoticeable. See Fig. 6, for an illustration of limiter action.

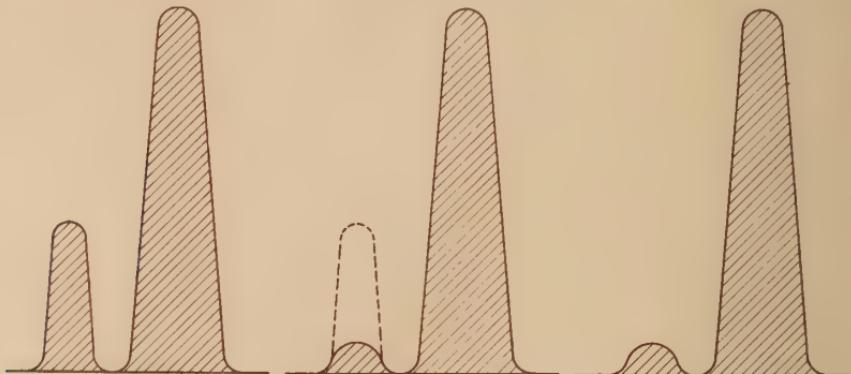


92X972

*Fig. 6. Noise limiter action.*

**USE OF CRYSTAL PHASING CONTROL** - This control permits the discrimination of interfering signals whose frequencies are very near the desired signal. To attain single signal reception with the SX-71, first set the RECEPTION switch to either BROAD CRYSTAL or SHARP CRYSTAL. Pick a good solid signal, preferably a commercial station because a commercial is likely to stay on long enough for you to complete the phasing adjustment for single signal reception.

You will find on tuning across this signal that it has two amplitudes. Now turn the CRYSTAL PHASING control until the weaker of the two amplitudes is reduced to a minimum. Then, tune to the stronger of the two amplitudes and adjust the PITCH control (for c-w reception) to a tone most pleasing to you. This adjustment for single signal selectivity will hold with no further adjustment unless you change the phasing control. See Fig. 7, for an illustration of single signal operation.



*Fig. 7. Single signal operation.*

92X974

**USE OF DIAL SCALES** - Two tuning procedures are normally used depending upon receiving requirements.

General Coverage Tuning - General broadcast reception and most shortwave broadcasting may be tuned in using the MAIN TUNING control and left hand dial scales. The frequency of reception is read directly from the left hand dial scales for bands 1 through 4 provided the band spread pointer of the right hand dial scales is set at 100 on the LOGGING SCALE. Band 5 is tuned with the BANDSPREAD control and the frequency of reception is read directly from the scale marked BAND 5. Note that the MAIN TUNING control has no tuning effect on this band.

Band Spread Tuning - Crowded shortwave broadcast and amateur radio bands require spread band tuning to permit effective use of these frequency ranges. To tune any one of the amateur bands, set the general coverage dial pointer in line with the correspond-

ing indexing dot, shown on the left hand dial scale, with the MAIN TUNING knob and tune the amateur band with the BAND SPREAD knob, reading the frequency of reception directly from the right hand dial scale in use.

To tune shortwave broadcast stations with the BAND SPREAD control; set the right hand, bandspread dial pointer at 100 or at the high frequency end of the dial scale; set the left hand, general coverage dial pointer slightly higher in frequency than the desired group of shortwave stations; and then tune in the stations with the BAND SPREAD control. Note that the frequency of reception can not be read directly from either set of dial scales for general shortwave reception, however, shortwave stations may be logged by recording the two pointer settings with the logging scales.

**USE OF THE "S" METER** - The "S" meter or tuning meter functions when the receiver is set up for amplitude modulated radio telephone reception and provides a means for setting the receiver "dead on" the carrier frequency and gives a relative reading of received signal strength. A true "S" meter reading is obtained only when the SENSITIVITY control is set for maximum sensitivity (Max. clockwise rotation.) and the receiver is tuned for the maximum meter reading.

The meter circuit is disabled for code or narrow band FM reception.

**NOTES ON NBFM RECEPTION** - When tuning in amateur radiophone stations using narrow band frequency modulation, tune for minimum distortion. Note that in general, the headset or speaker volume is slightly less than for AM phone reception. This is normal. However, when the volume level is very low, it indicates that the deviation of the FM signal is considerably below  $\pm 2\frac{1}{2}$  KC. When the received signal is loud and very distorted, the transmitted signal has a deviation in excess of  $\pm 2\frac{1}{2}$  KC. In extreme cases of distortion, reception may be attempted by switching to normal AM reception and tuning off to one side of the transmitted carrier as is customary with receivers not equipped with FM detectors, however, in this case the quieting effects of FM are not available. The SX-71 receiver has been designed to provide optimum results when receiving FM signals having a maximum of  $\pm 2\frac{1}{2}$  KC deviation. It should also be noted that when the receiver is switched to NBFM, the "S" meter is rendered inoperative.

**RECORD PLAYER OPERATION** - With a record player connected to the receiver it is merely necessary to set the RECEPTION control at PHONO and operate the VOLUME and TONE controls as for normal radio reception.

**CAUTION** - The receiver will not respond if the RECEIVE / STANDBY switch is set at STANDBY. The setting of the remaining controls, except those mentioned above, is immaterial as they are not in use for record player operation.

**HEADPHONE OPERATION** - A headset jack located in the front panel, provides for headphone reception. Insertion of the headset plug disables the speaker. Any standard headphone of low or medium impedance will work with the receiver.

**SPEAKER OPERATION** - Three screw type terminals provide 3.5 and 500 ohms output impedance and are located on the rear chassis apron. For maximum audio fidelity, it is recommended, that a bass reflex speaker such as the Hallicrafters R-42 be employed and connected to 500 and G terminals. For economy, the Hallicrafters R-46 speaker may be used by connection to the G and 3.5 ohm terminals.

# SERVICE

**TUBE REPLACEMENT** - The types of tubes required and their relative position in the receiver are shown in the illustration, Fig. 8. When installing a replacement tube, insert the center guide pin into the center hole of the tube socket; rotate the tube until the key on the guide pin drops into the notch in the socket hole; push down until the base of the tube rests firmly on the socket. A slightly different technique must be used on the miniature tubes. They have seven small pins which have to be lined up with the socket holes before pushing into place. Handle with care as all tubes are considered fragile and do not tolerate much mechanical abuse.

**CLEANING AND REPLACEMENT OF DIAL GLASS** - To clean or replace the dial glass, it will be necessary to remove the front panel from the chassis to gain access to the glass. To do this, first remove all knobs and hex nuts holding the potentiometers and jacks to the panel. Then remove the four screws from the front of the panel and the screws on the side and bottom. The front panel can then be removed from the chassis.

**SERVICE OR OPERATING QUESTIONS** - Factory type service is available at Hallicrafters Authorized Field Service Centers. For Warranty Service information or further details regarding operation or servicing of the receiver in general, contact the dealer directly. Make no service shipments directly to the factory before first writing for authorization and instructions. The factory cannot accept responsibility for unauthorized shipments.

**SERVICE LITERATURE** - If a service manual was not packed with this receiver, advise the Hallicrafters Company on the guarantee card and one will be forwarded..

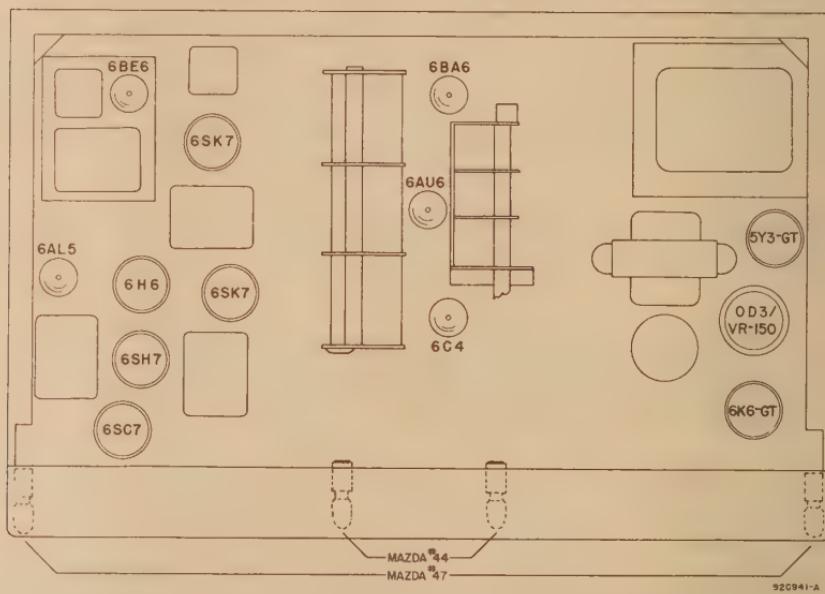


Fig. 8. Top view showing location of tubes and dial lamps.

**DIAL LAMP REPLACEMENT** - Refer to Fig. 8 for the location of the dial lamps in the receiver. Access to defective lamps, may be gained through the top cabinet cover. The two end lamps are fastened by screws to an angle bracket. Remove the screws and change the lamp using a 6-8 V. Mazda #47 (brown bead) or equivalent. To change the two dial lamps in the center, it is necessary to unscrew the two screws holding the sockets in place. These two lamps should be replaced with 6-8 V. Mazda #44 (blue bead) or equivalent.

## **NOTES**

## **Warranty**

*The Hallicrafter's Company warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to our authorized radio dealer from whom purchased, wholesaler, or service center, intact, for examination, with all transportation charges prepaid within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.*

*This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.*

*Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.*

*This warranty is in lieu of all other warranties expressed and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.*

are simple to make. They are easy to connect and disconnect as no locking ring or threaded sleeve must be handled. They are not expensive like the BNC. They do not come loose like a PL259. The losses in the VHF range are not measureably different when any of the three types are compared. The only reason for using BNC connectors is where all other connections in the station are made with BNC's. In this case, either an adapter BNC to auto radio connector can be made easily or the jacks removed from the converter and the one-hole-mount BNC jack substituted. The hole is the correct size.

#### ANTENNA REQUIREMENTS

Any type of antenna, except long wire, may be used with this converter. A rotatable beam is preferred; however, a quarter wave whip, a ground plane, a beam or halo type may be used. While the input and output impedance is not critical, it is nominally 50 ohms and 50 ohm coaxial cable should be used between the antenna and the converter. 75 ohms will work well also. If the antenna terminates at 300 ohms and 300 ohm transmission line is used, then a matching balun should be used between the line and the converter.

#### GAIN CONTROL

Maximum gain and best noise figure are obtained when the gain control on the converter (R4) is at maximum. If interference is experienced from a nearby very strong signal, this gain control can be turned down to eliminate it. The converter gain control should be used for this purpose only. The receiver RF gain control should be used when less overall gain is desired.

#### PREAMPLIFIERS

The CN converters have very high gain. No improvement in weak signal reception can be had by placing a Nuvistor Preamplifier between the antenna and a CN converter as the CN converter already has two of them built in. When a third stage is added, it is probable that overloading of one or more stages will occur in the receiver and/or the converter, even on moderate signals.

#### SELECTING THE OUTPUT IF FREQUENCY

This converter may be adjusted so that it will provide any output frequency between 0.5 Mc. and 35 Mc. for the CN-50, and 0.5 Mc. and 55 Mc. on the CN-144 and CN-220. This feature of the converter will prevent it from becoming obsolete should the receiver be changed to a different type.

If there is a choice as to what output frequency to use, it is recommended that a low output frequency be used - preferably 7-11 Mc. This is because most receivers perform best in this range. Their oscillator stability (drift), image and spurious rejection become progressively poorer as the frequency goes up.

On receivers covering ham bands only, the 28-30 Mc. band gives the most coverage for use with a converter.

The following table shows the crystal frequencies to be used to obtain the various IF outputs from the converter and any other changes required. See drawing of L6 (A7596C) terminal arrangement on Page 5 for position of the jumper.

#### FREQUENCY TABLES

CN-50						
To Receive Mc.	IF Output Mc.	Crystal Mc.	C23 mmfd. See Note B	L6 Jumper	L7 Link	
50-54	7-11	43	Not used	Remove jumper	Next to winding	
50-54	10-14	40	Not used	from B to A	Over winding	
50-54	14-18	36	5	from B to F	Over winding	
50-54	26-30	24	22	from B to E	Over winding	
50-54	28-32	22	22	from B to E	Over winding	
50-54	30.5-34.5 Note E	19.5	50	from B to E	Over winding	
50-51 } Broadcast		49.4	Not used	See Note A	Next to winding	
51-52 }	(600-1600 Kc.)	50.4	Not used	See Note A	Next to winding	

CN-144						
To Receive Mc.	IF Output Mc.	Crystal Mc.	Multiplier Output Mc. See Note B	C31 mmfd. See Note B	L8 Turns	L7 Link
144-148	7-11	45.6667	137	Not used	7	Next to winding
144-148	10-14	44.6667	134	Not used	7	From B to A
144-148	14-18	43.3333	130	Not used	7	From B to F
144-148	26-30	39.3333	116	5	7	From B to E
144-148	28-32 Note C	38.6667	116	5	7	Over winding
144-148	30.5-34.5 Note E	37.8333	113.5	5	8	Over winding
144-148	50-54	31.3333	94	10	9	Over winding
144-148 )	Broadcast	47.8000	143.4	Not used	7	Next to winding
145-146 )	(600-1600 Kc.)	48.1333	144.4	Not used	7	Next to winding
146-147 )		48.4667	145.4	Not used	7	Next to winding

CN-220						
To Receive Mc.	IF Output Mc.	Crystal Mc.	Multiplier Output Mc. See Note B	C31 mmfd. See Note B	L7 Link	L6 Jumper
220-225	7 to 12	53.2500	213	Not used	Next to winding	Remove jumper
220-225	10 to 15	52.5000	210	Not used	Next to winding	From B to A
220-225	14 to 19	51.5000	206	Not used	Next to winding	From B to F
220-225	26 to 31	48.5000	194	Not used	Next to winding	From B to E
220-225	28 to 33	48.0000	192	Not used	Next to winding	From B to E (see Note C)
220-225	30 to 35 Note E	47.5000	190	Not used	Next to winding	From B to E
220-225	50 to 55	42.5000	170	5	Next to winding	See Note D
220-225	Broadcast	Not recommended				

NOTE A: L6 jumper can be in any position as it does not operate on broadcast. Remove the 330 ohm resistor and 100 mmfd. condenser from J2.



NOTE B: C23 or C31 is a capacitor that is connected from the crystal socket X5 pin #1 to L7 terminal nearest to the side of the chassis.

NOTE C: In many Amateur Band only receivers, the best band for use with converters is the 28 to 30 Mc. band. As an example: to cover 144 to 148 Mc., two crystals can be used; a 38.6667 Mc. crystal will permit reception of 144 to 146 Mc. and a 39.3333 Mc. crystal will permit reception of 146 to 148 Mc. The oscillator can be adjusted for good performance with both crystals without retuning when crystals are changed.

NOTE D: Add Ameco Coil #RL-3254 from B to C.

NOTE E: Cut R8 from terminal C on L6 and solder it to terminal B.

#### ALIGNMENT

All wired and tested converters have been carefully aligned and their performance measured with laboratory test equipment. Then they are checked on the air. If your antenna is close to 50 ohms, no adjustments are needed.

#### INSTRUMFNTS REQUIRED:

1. Vacuum tube voltmeter or sensitive voltohmimeter.
2. Signal generator or other signal source such as a VFO, a heterodyne frequency meter or a transmitter.
3. Receiver.
4. Aligning tools, including a .100" hexagonal plastic or nylon alignment wrench.

#### ALIGNMENT PROCEDURE:

Alignment must be performed with the bottom cover in place. You will note two holes through which you can adjust the alignment trimmers, C13 (or C16) and C5.

#### CN ALIGNMENT - ALL MODELS

1. Adjust the six piston trimmers on top of the CN-144 or CN-220 chassis so that 1/2" of the trimmer screw is exposed above the trimmer housing. Adjust the six hexagonal core slugs on the CN-50 and the single hexagonal core slug on the CN-144 and CN-220 so that the slugs are approximately centered in the coils. Connect the converter to your receiver and power supply. Connect VTVM from the test point TP to ground. See Fig. 3 for the location of this point. Adjust the VTVM to a low scale setting to read -DC volts. Wherever 6CW4 is mentioned, 6CW4 or 6DS4 can be used without changes or adjustments.

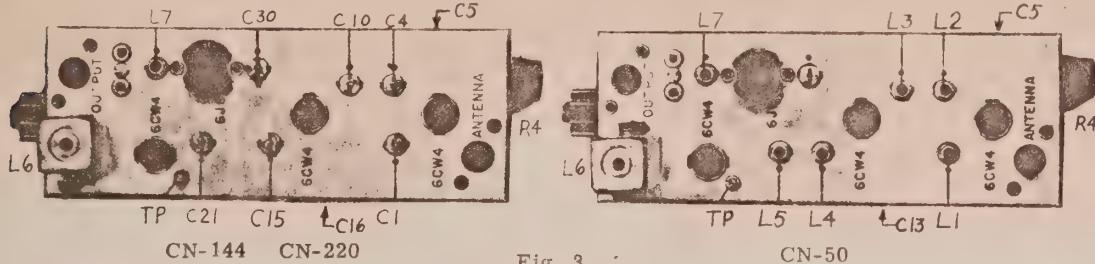


Fig. 3

2. Insert V4 - 6J6 oscillator-multiplier and V3 - 6CW4 mixer only. Oscillator alignment: Turn L7 counter-clockwise until the slug is at the top of the housing.
3. Turn L7 clockwise until the VTVM goes to a maximum reading and then drops sharply. At this point, turn L7 one turn counter-clockwise. If no reading is obtained at the test point, connect the VTVM through a 100K resistor to pin 5 of X4 to check the oscillator. Typical readings are -5 to -18 volts maximum, depending on crystal and crystal frequency. Should you fail to get a reading of over -4 volts at this point, it is an indication of a malfunction in the oscillator circuit. If the reading at this point is normal in the CN-50 and you get no reading at point TP, check the unit for wiring error or omission in the mixer or oscillator stage. If the reading at this point is normal in the CN-144 or CN-220 and you get no reading at point TP, it is an indication of a probable gross missetting of capacitor C-30 or an error in wiring in the mixer stage.
4. (Models CN-144 and CN-220 only). With the VTVM at test point TP, adjust C30 for maximum.

**NOTE: DO NOT disconnect the VTVM from the test point TP until the alignment is completed.**

5. There will be a drop in voltage on the VTVM if we remove the crystal. Adjust L7 until the difference in voltage between the crystal in and the crystal out is no less than 1.0 volt and no more than 1.7 volts. For instance, an optimum reading is -2.2 volts with the crystal in and -0.5 volt with the crystal out.
6. Insert V2 - 6CW4 - 2nd RF amplifier. Turn the gain control fully clockwise. Remove the crystal from the socket and set it aside.
7. Adjust the 2nd RF stage neutralizing capacitor (C-13 on the 50 Mc. models, C-16 on the 144 Mc. and 220 Mc. models) through the left side hole on the bottom cover of the chassis. The left hole is the one furthest away from the front of the chassis. Do not confuse this with the hole in the right side of the bottom



cover which is closer to the front of the chassis. Adjust this 2nd stage neutralizing trimmer by turning it clockwise until the VTVM swings up scale (indicating oscillation). At this point, SLOWLY turn the trimmer counterclockwise one half turn past the point where the oscillation stops. This must be done with an insulated screwdriver (the type with a very small steel piece in the end of a plastic rod).

8. Insert V1 - 6CW4, 1st RF amplifier. Adjust C5 (the 1st RF stage neutralizing capacitor located through the side hole on the right side of the bottom cover, closest to the front of the chassis) using the same procedure as in step 7.

9. Feed in a signal to J1 at about 50.5, 146 or 221.5 Mc., depending on your model, and tune L2, 3, 4, 5 on the 50 Mc. unit (or C1, C4, C10, C15, C21 on the 144 or 220 Mc. units) for maximum. Keep the output below 3 volts by reducing the signal input as you proceed through the alignment steps. If voltage will not go down, repeat steps 7 and 8.

10. Disconnect R2 at point A, increase the signal strength enough to move the meter 1/4 to 1/2 volt and readjust C5 for MINIMUM meter reading.

11. Reconnect R2 to point A but do not solder.

12. Disconnect R5 from point B and repeat step 10, adjusting C13 or C16 instead.

13. Reconnect R5 to point B but DO NOT solder.

#### MODEL CN-50 ONLY

14a. Tune the signal source to 51 Mc. and adjust L4 and L5 for maximum output on the VTVM.

14b. Tune the signal source to 50 Mc. and adjust L2 and L3 for maximum output on the VTVM.

14c. Tune the signal source to 49.5 Mc. and adjust L1 bottom core for maximum output (this tunes broadly).

14d. Tune the signal source to 50.5 Mc. and adjust L1 top core for maximum output (this tunes broadly).

NOTES: If there is any pronounced peak when tuning across the band, L2 can be adjusted slightly to smooth the response. It seldom requires more than one turn.

Bandwidth is controlled by the position of the "figure 8" links on L2 and L5. Typical adjustment is with the link at the end of the winding on L2 but not covering any turns. The other end of the link should be around the winding of L3. The other link should be around the winding of L4 and near the end of L5, covering 2 or 3 turns. Bandwidth is increased by moving the links to cover more of the windings on L2 and L5, decreased by bending the links away from the windings. Mid-band gain is little affected by these adjustments.

#### MODEL CN-144 ONLY

14a. Tune the signal source to 148.0 Mc. and adjust C4 and C21 for maximum output on the VTVM.

14b. Tune the signal source to 150 Mc. and adjust C10 for maximum output. If 150Mc. is not available, tune at 148 Mc. and turn C10 two turns counter-clockwise from the peak reading.

14c. Tune the signal source to 144 Mc. and adjust C1 and C15 for maximum output. Then turn C1 - 2 turns CW.

NOTE: If there is any pronounced peak in noise when tuning across the band, C4 can be adjusted slightly to smooth the response on CN-144, C10 on CN-220. It seldom requires more than one turn.

#### MODEL CN-220 ONLY

To align the CN-220, the bottom cover must be removed.

A loading unit consisting of a .001 mfd. ceramic capacitor in series with a 1000 ohm carbon resistor will be required. The leads must be very short. To use the loading unit, connect it across the coil or from the hot side of the coil to the chassis. If it is fastened to a plastic rod, it will be most convenient to use.

14a. Tune the signal source to 220 Mc. and adjust C1 for maximum output, then detune one turn clockwise.

14b. Tune the signal source to 222.5 Mc. and adjust C4 for maximum output with load across L3.

14c. Tune the signal source to 222.5 Mc. and adjust C10 for maximum output with load across L2.

14d. Tune the signal source to 222.5 Mc. and adjust C15 for maximum output with load across L5.

14e. Do not adjust C21.

#### ALL MODELS

15. Step 14 for all models should be repeated at least once as there is interaction between the various adjustments.

16. Insert the crystal and tune the receiver to the center of the band of interest - 51 Mc., 146 Mc., 222.5 Mc.

17. In this step, do not attempt to use the "S" meter on your receiver. Turn off the AVC circuit or keep the signal level so low that the slightest change in noise level from the speaker will be quite noticeable. Carefully adjust L6 for maximum audio output. Typical settings are as follows: 7-11 Mc., the slug near the top of the can, 14-18 Mc., the slug near the center of the can, 28-30 Mc., the slug near the bottom of the can. There will be no changes in voltage at test point TP during this step.

18. To check for stability, reduce the signal input from the generator and rotate the gain control from full clockwise to full counterclockwise several times while watching the VTVM. The voltage at point TP should not vary very much. If the meter jumps up or down the scale, the neutralization adjustments must be repeated.(steps 10, 11, 12 and 13).

19. Disconnect the signal generator and repeat the checks in step 18.

20. Connect the antenna and repeat the checks in step 18.

21. If it all checks OK, solder points A and B.

Note that if, at a later date, or with change of antenna, the RF amplifier oscillates, a quarter turn on C5, or occasionally C13 or C16 will stop the oscillation. It is not necessary to go through the original procedure. Normally no adjustment is required when tubes are replaced.

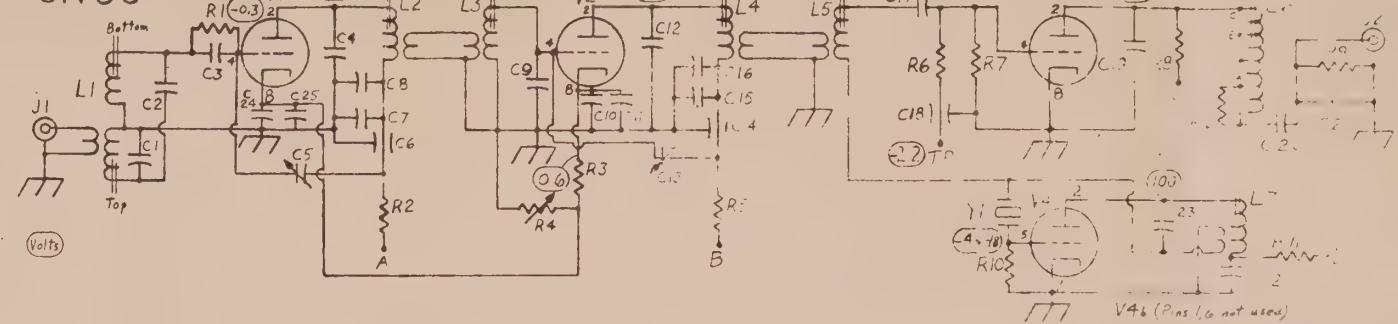
22. Repeat steps 4 and 5 to adjust the oscillator injection level.

NOTE: The above procedures will give satisfactory results with the commonly available test equipment usually found in an amateur station. If you have a good sweep generator, marker generator and oscilloscope, somewhat more even gain can be produced, usually within  $\pm 1.5$  db.

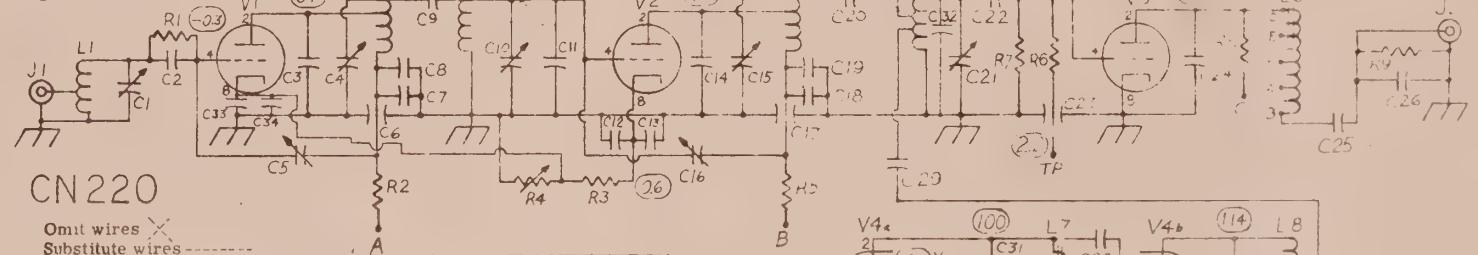


# SCHEMATICS

**CN 50**

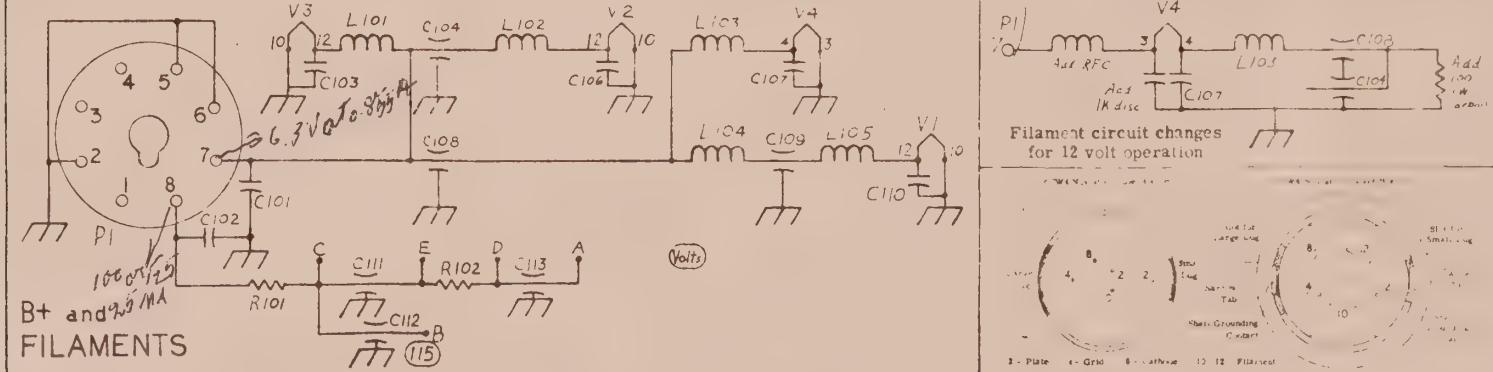
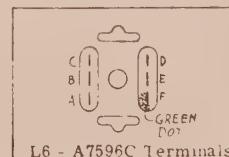


**CN 144**



**CN 220**

Omit wires ~~X~~  
Substitute wires ~~-----~~  
Change C9 to 0.5 mmfd.  
Omit C11, C32





# PARTS LIST

All capacitance values given in mμfd.  
All resistance values given in ohms.

K - X 1,000      M - X 1,000,000  
All resistors are 1/2 watt, except as noted.

CN-50		CN-144, 220		CN Filament and B+	
C 1 5 disc	L 1 Antenna transformer, Ameco CN50T1	C 1 1 to 8 trimmer	C 33 1900 disc	C101 5000 disc	
C 2 1 tubular	L 2 9 turn coil, Ameco CS-1	C 2 100 tubular	C 34 1000 disc	C102 5000 disc	
C 3 100 tubular	L 3 6 turn coil, Ameco CS-1	C 3 5 disc	J 1 Antenna jack	C103 1000 disc	
C 4 10 disc		C 4 1 to 8 trimmer	J 2 Output jack	C104 1000 feedthru	
C 5 1 to 5 trimmer	modified	C 5 1 to 5 trimmer	L 1 4 turns tap at 1-1/2	C106 1000 disc	
C 6 1.5 feedthru	L 4 9 turn coil, Ameco CS-1	C 6 1.5 feedthru	L 2 7 turns tap at 2	C107 1000 disc	
C 7 10 disc	L 5 9 turn coil, Ameco CS-1	C 7 10 disc	L 3 2-1/2 turns	C108 1000 feedthru	
C 8 10 disc	L 6 Output transformer,	C 8 10 disc	L 4 Same as L2	C109 1000 feedthru	
C 9 5 disc	Ameco A7596C	C 9 1.0 tubular	L 5 4 turns	C110 1000 disc	
C10 1000 disc	L 7 9 turn coil, Ameco CS-1	C10 1 to 8 trimmer	L 6 Output transformer, Ameco A7596C	C111 1000 feedthru	
C11 1000 disc		C11 5 disc	C12 1000 disc	C112 1000 feedthru	
C12 10 disc	P 1 47K	C12 1000 disc	L 7 Ameco CS-1	C113 1000 feedthru	
C13 1 to 5 trimmer	R 2 6.8K, 1 watt	C13 1000 disc	L 8 See table		
C14 1.5 feedthru	R 3 100	C14 5 disc	R 1 47E	L101 filament choke	
C15 10 disc	R 4 1000 ohm	C15 1 to 8 trimmer	R 2 6.8K, 1 watt	L102 filament choke	
C16 10 disc	rheostat	C16 1 to 5 trimmer	P 3 100	L103 filament choke	
C17 22 disc	R 5 6.8K, 1 watt	C17 1.5 feedthru	P 4 1000 ohm rheostat	L104 filament choke	
C18 1000 feedthru	R 6 100K	C18 10 disc	R 5 6.8K, 1 watt	L105 filament choke	
C19 10 disc	R 7 1.0M	C19 10 disc	R 6 1.0M		
C20 5000 disc	R 8 4.7K	C20 1.0 tubular	P 7 100K	P 1 Power plug, octal mate	
C21 100 tubular	R 9 330	C21 1 to 8 trimmer	P 8 1.0M	R101 100	
C22 1000 disc	R10 100K	C22 22 disc	R 9 390	R102 100	
C23 See table	R11 4.7K	C23 1000 feedthru	R10 100K		
C24 1000 disc	R12 4.7K	C24 10 disc	R11 4.7K		
C25 1000 disc	V 1 6CW4 or 6DS4	C25 5000 disc	R13 100K		
J 1 Antenna jack	V 2 6CW4 or 6DS4	C26 100 tubular	V 1 6CW4 or 6DS4	V 1 6CW4 or 6DS4	
J 2 Output jack	V 3 6CW4 or 6DS4	C27 1000 disc	V 2 6CW4 or 6DS4	V 2 6CW4 or 6DS4	
	V 4 6J6	C28 22 disc	V 3 6CW4 or 6DS4	V 3 6CW4 or 6DS4	
	Y 1 Crystal, see table	C29 1000 disc	C30 1 to 8 trimmer	V 4 6J6	
		C31 See Table	C32 5 disc	Y 1 Crystal, see table	

## GUARANTEE

The American Electronics Co. guarantees each component to be free from defect and agrees to furnish a new part in exchange for the old, provided such part is returned to us intact, for our examination, with all transportation charges prepaid to our factory, within ninety (90) days from the date of purchase, and provided that such examination discloses, in our judgment, that it is thus defective and not a result of poor construction practices or use on the part of the kit constructor or user. In returning a part, the following conditions must be fulfilled: Identify the part number as listed in the parts list in this book. State the type and model of the equipment for which the component is required. List the dealer and date of purchase and provide complete details relative to the defect.

This warranty does not extend to any equipment which has been subjected to misuse, neglect, accident or improper wiring in violation of the instructions furnished by us.

This warranty shall not take effect and will be considered void unless the enclosed registration card is returned to us within ten (10) days of the date of purchase.

If trouble develops in your unit during the guarantee period which you cannot remedy yourself, write to our Service Department, listing all possible indications that might be helpful. We will then write to you and tell you what to do. If the unit is not in warranty or was built from a kit, you may return the unit to our factory where it will be placed in operating condition. The minimum charge for this service will be \$3.00 provided that it does not require more than one-half hour of bench work. Any unit that requires more than one-half hour of work will be held until the purchaser has received and approved an estimate of total repair costs. There will be a charge for parts replaced due to their being damaged in the course of construction.

**NOTE:** Before returning this unit, be sure that all parts are securely mounted. Equipment will be serviced only if it has been completely wired and assembled in accordance with the instructions contained in this manual. Equipment that has been constructed in any other manner, that has been modified in any way, that has been wired with acid core solder, soldering paste or liquid flux of any type, or that is incompletely assembled will not be repaired but will be shipped back to the sender COLLECT.

Attach a tag to the unit giving your name, home address and the trouble experienced. Pack very carefully in a rugged container. THE CARTON THAT THE UNIT WAS PACKED IN IS NOT SUITABLE AS AN EXTERIOR SHIPPING CONTAINER. Pack in a box at least two inches larger on all sides. Use sufficient packing material (cotton, shredded newspaper or excelsior) to make the unit completely immovable within the container. Ship by Prepaid Insured Parcel Post or Prepaid Railway Express to:

AMECO EQUIPMENT CORP.

178 Herricks Road

Mineola, L.I., N.Y.

Return shipment will be made by Express Collect or Parcel Post C.O.D.

We are not responsible for damage that occurs in transit. The consignee must file claims for recovery with the carrier. Note that a carrier cannot be held liable for damages in transit if packing, IN HIS OPINION, is insufficient.

We reserve the right to change parts and/or specifications at any time, without being obliged to modify existing units or those already sold in like manner.



# **PCI to USB 2.0 Host Controller (3 Ports)**

*USER'S MANUAL*

## ◎ Introduction

The Card complies with the Universal Serial Bus Specification Revision 2.0 and Universal Host Controller interface Specification for full-/low-speed data rate and Intel's Enhanced Host Controller interface Specification for high-speed data rate and works up to 480Mbps.

The Card fully meets PCI specification V2.2. It is now supported by USB operating system; such as Windows 98SE, Windows ME, Windows 2000 and Windows XP platform. It offers simple, flexible and highly scalable connectivity between PC and full range of peripherals.

## ● Features

- ★ Universal Serial USB Specification Revision 2.0 compliant (Support 1.5/12 /480 Mbps data rate).
- ★ Integrated multi-PCI functions into a single chip that included two UHCI host controllers for Low/Full speed data transaction and one EHCI host controller for High-speed data transaction.
- ★ Tree downstream ports and each port full support Low/Full/High speed data rate.
- ★ PCI Specification Revision 2.2 compliant.
- ★ PCI bus Power Management Interface Revision 1.1 compliant.
- ★ 3.3V/2.5V multi-power supply and 3.3V suspend power for wake-up function.
- ★ Supported Windows 98SE / Windows ME / Windows 2000 / Windows XP.

## ● System Requirements

- ★ IBM or compatible systems with a 586 or faster processor ( Pentium II processor recommended )
- ★ The PC must be 100% PCI compatible
- ★ One available PCI slot
- ★ Windows® version (Windows 98SE / Windows ME / Windows 2000 / Windows XP)
- ★ 64 Megabytes ( MB ) of memory

## ● Package Contents

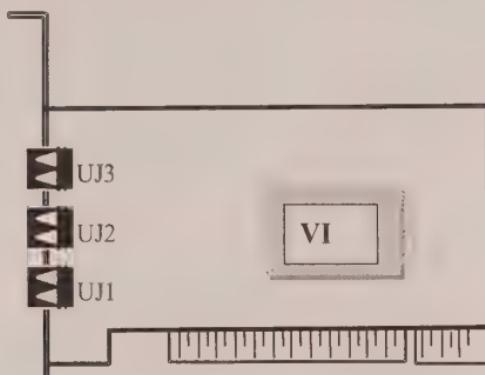
*Following items are included in the packaging carton:*

- ★ Color box
- ★ One USB card Packaged by Static resistant bag
- ★ User's manual
- ★ Disk or CD Disk

*If items are damaged or missing, please contact your dealer.*

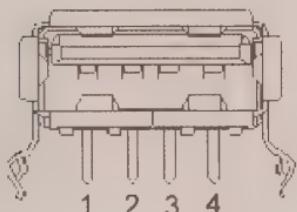
## ◎ Hardware installation

### USB controller card layout

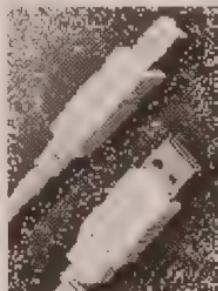


Board Location	Port Name	Connector Type
UJ1 ~ UJ3	USB port A	4pin A-type USB connector

USB port (A Type)



USB Connector



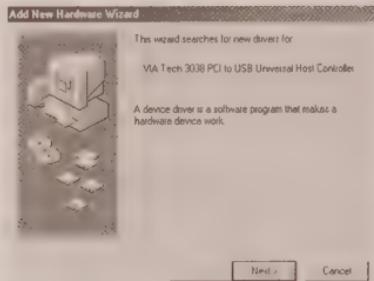
PIN	SIGNAL
1	VCC
2	DATA-
3	DATA+
4	GND

## ◎ Software installation

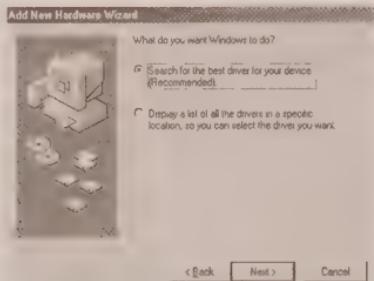
Here will tell you how to set up your USB controller card. The USB controller card is in Plug and Play. **It means there are no jumpers, IRQs, or DIP switches setting to configure.**

### ● Windows® 98SE setup

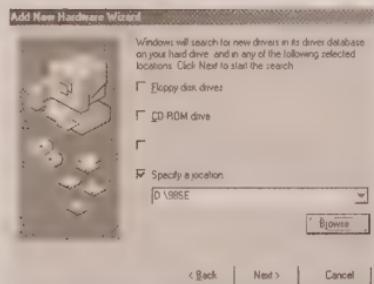
1.Windows 98SE will detect the USB Card and display a dialog and click "Next".



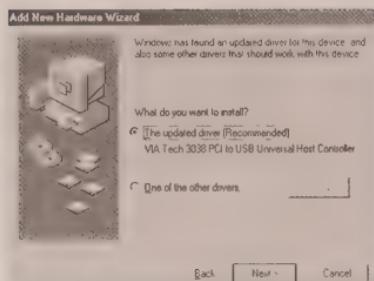
2.Select "Search for the best driver for your device.[Recommended]." and click "Next".



3.Click "Next".



4.Click "Next".



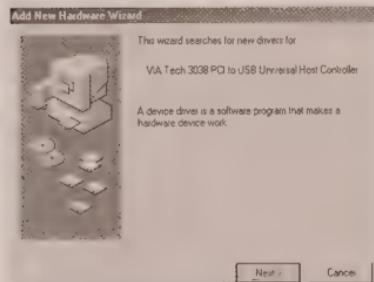
5.Click "Next".



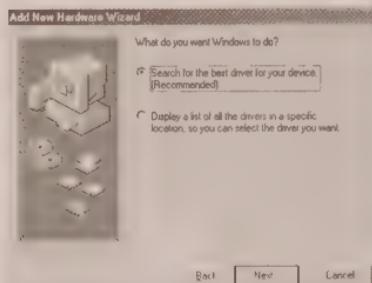
6.Click "Finish".



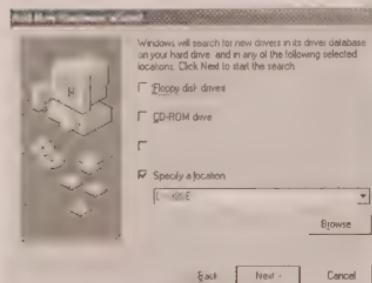
7.Click "Next".



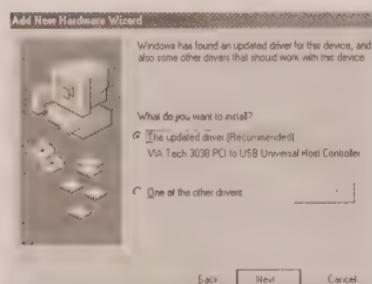
8. Select "Search for the best driver for your device.[Recommended]." and click "Next".



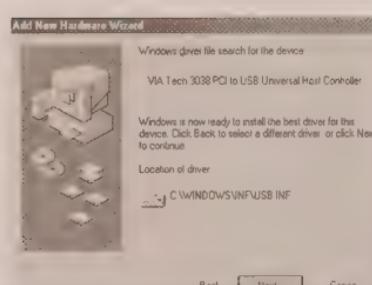
9. Click "Next".



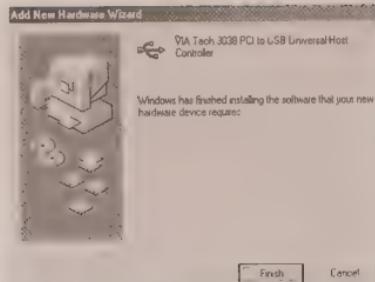
10. Click "Next".



11. Click "Next".



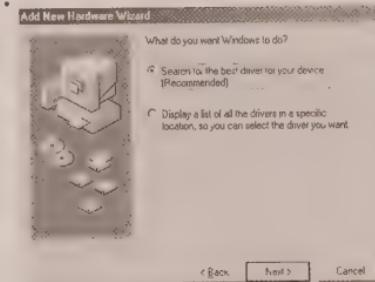
12.Click "Finish".



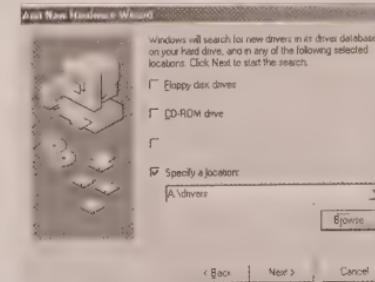
13.Click "Next".



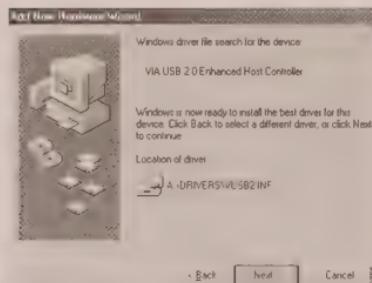
14.Select "Search for the best driver for your device.[Recommended]" and click "Next".



15.Insert "Floppy disk driver" or "CD-ROM driver" and click "Next"



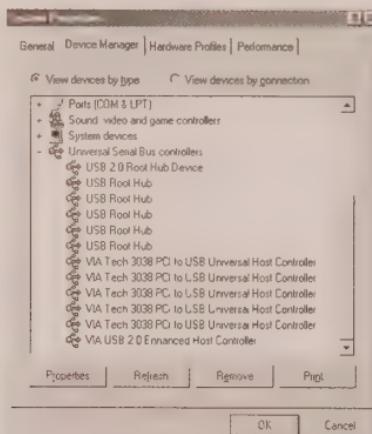
16. Click "Next".



17. Click "Finish".

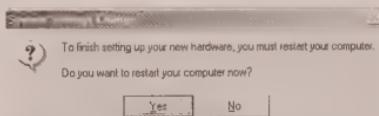


18. When Device Manager ("My Computer" → "Control Panel" → "System" → "Device Manager" → "Universal Serial Bus controllers") shows "USB 2.0 Root Hub Device" and "VIA USB 2.0 Enhanced Host Controller". It means it is installed correctly.

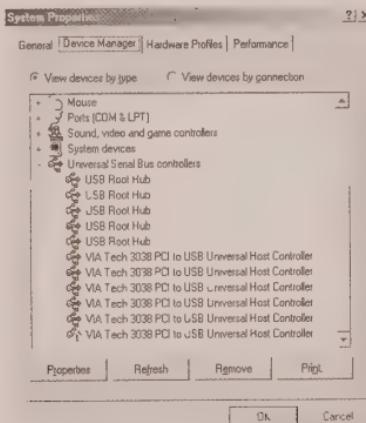


## ● Windows® ME setup

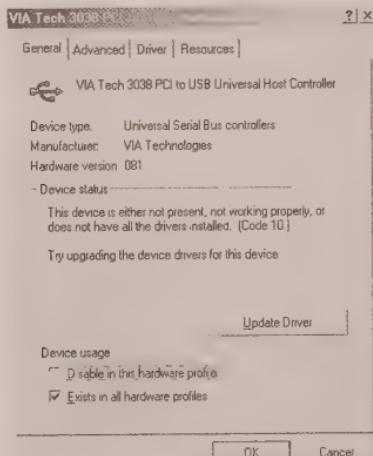
1. Windows ME supports **PnP (Plug-n-Play)** mode and will install the USB Card driver directly.  
Windows ME will detect the USB Card and display a dialog and click "Yes".



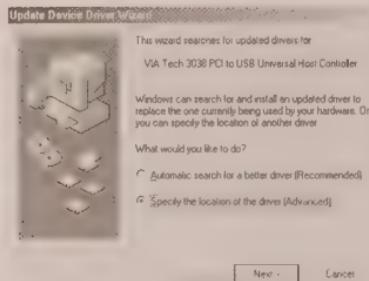
2. Click the path : "**My Computer**" → "**Control Panel**" → "**System**" → "**Device Manager**" → "**Universal Serial Bus controllers**".  
You will see the "**Yellow Mark**". It means you have to update the new driver.  
Subsequently double click this "**Yellow Mark**" field.



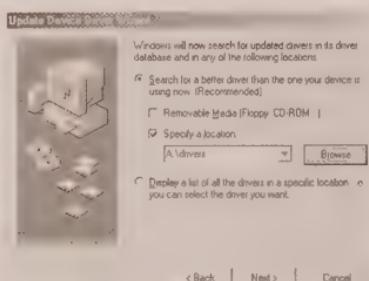
3. Select "**Update Driver**"



4. Select "Specify the location of the driver [Advanced]" and click "Next".



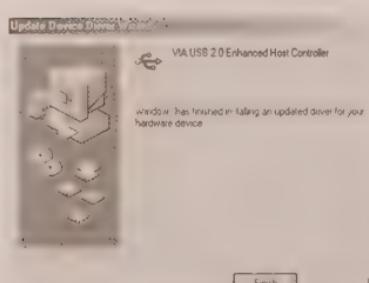
5. Insert "Floppy disk driver" or "CD-ROM driver" and click "Next".



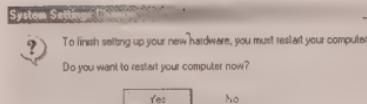
6. Click "Next".



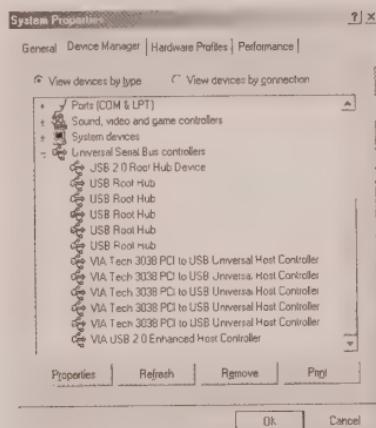
7. Click "Finish".



8.Then click "Yes".



9 When Device Manager ( "My Computer" → "Control Panel" → "System" → "Device Manager" → "Universal Serial Bus controllers" ) shows "**USB 2.0 Root Hub Device**" and "**VIA USB 2.0 Enhanced Host Controller**". It means it is installed correctly.

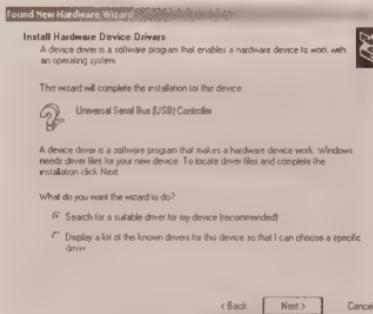


## ● Windows® 2000 setup

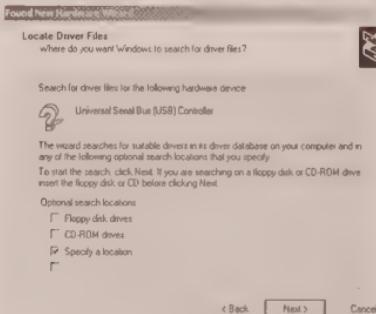
1. Windows 2000 supports **PnP (Plug-n-Play)** mode and will install the USB Card driver directly.  
Windows 2000 will detect the USB Card and display a dialog, and click "Next".



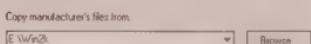
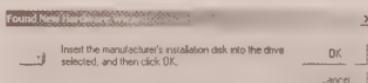
2. Select "Search for a suitable driver for my device [recommended]" and click "Next".



3. Select "Specify a location" and click "Next".



4. Insert "Floppy disk driver" or "CD-ROM driver" and click "OK".



5. Click "Next".



6. Then click "Finish".



7. When Device Manager ( "My Computer" → "Control Panel" → "System" → "Hardware" → "Device Manager" → "Universal Serial Bus controllers" ) shows "USB 2.0 Root Hub Device" and "VIA USB 2.0 Enhanced Host Controller". It means it is installed correctly.



## ● Windows® XP setup

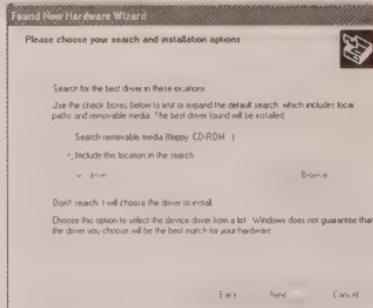
1. Windows XP supports **PnP (Plug-n-Play)** mode and will install the USB Card driver directly

2. Windows XP will detect the USB Card and display a dialog.

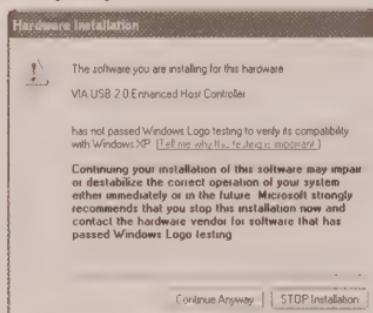
Select "**Install from a list or specific location [Advanced]**" and click "**Next**".



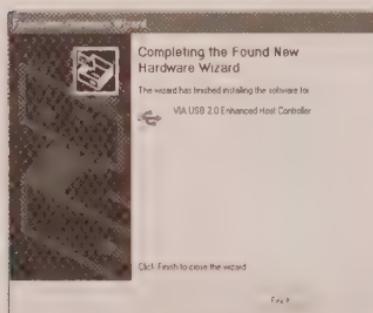
3. Insert "Floppy disk driver" or "CD-ROM driver" and click "Next".



4. Select "Continue Anyway".



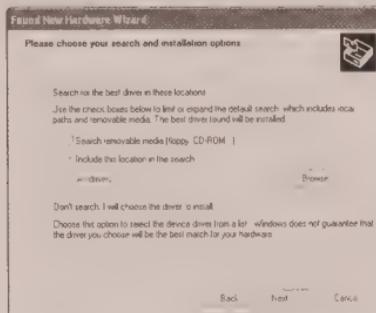
5. Click "Finish".



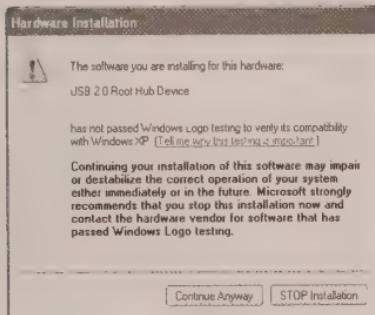
6. Select "Install from a list or specific location [Advanced]" and click "Next".



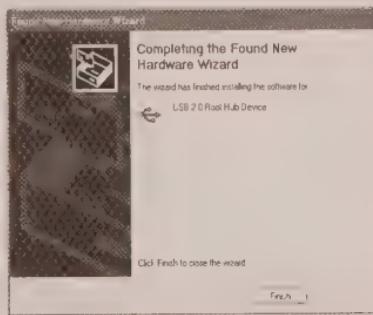
7. Insert "Floppy disk driver" or "CD-ROM driver" and click "Next".



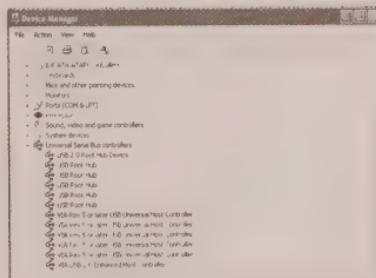
8. Select "Continue Anyway".



9. Then click "Finish".



10. When Device Manager ( "My Computer" → "Control Panel" → "Performance and Maintenance" → "System" → "Hardware" → "Device Manager" → "Universal Serial Bus controllers" ) shows "USB 2.0 Root Hub Device" and "VIA USB 2.0 Enhanced Host Controller". It means it is installed correctly.



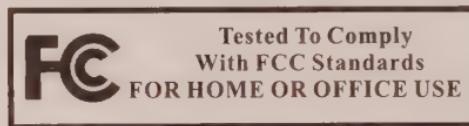
## ***Acknowledgements***

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Intel and Pentium are registered trademarks of Intel Corporation.

Microsoft and Windows are registered trademarks of Microsoft Corporation.

All other brand names and trademarks used here are trademarks of their respective owners.



This device is in conformance with Part 15 of the FCC Rules and Regulations for Information Technology Equipment. Operation of this product is subject to the following two conditions:(1) This device may not cause harmful interference, and (2) This device accept any interference received, including interference that may cause undesired operation.

### **FCC NOTICE**

This equipment has been tested and found to comply with the limits for a Class B Computing Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential Installation. This equipment generates, uses, and can radiate radio frequency energy and If not installed and used in accordance to the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio and television reception, which can be determined by turning the equipment off and on, the user is encouraged trying to correct the interference by one or more of the following measures:

- ※ Reorient or relocate the receiving antenna.
- ※ Increase the separation between the equipment and the antenna.
- ※ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ※ Consult the dealer or an experience radio or TV technician for help.

### **IMPORTANT**

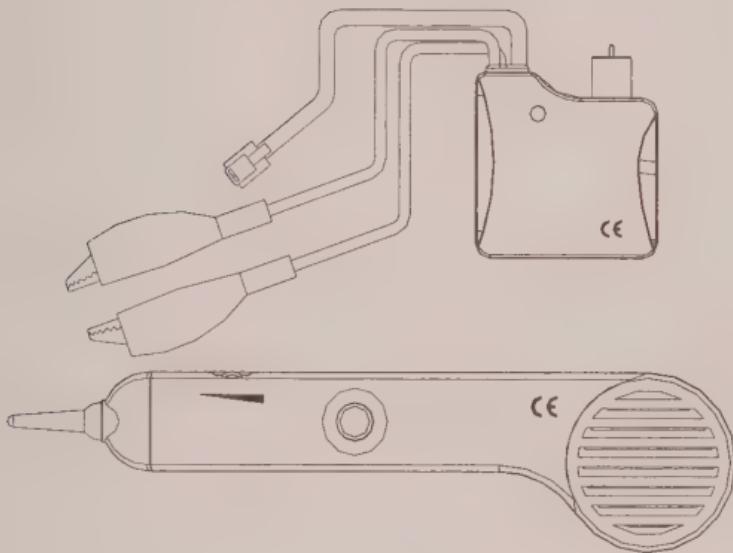
Any changes or modifications not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment.

This product requires the use of shielded cables in order to comply with FCC requirements.

# User's Guide

## Tone Generator and

## Amplifier Probe





## ***Introduction***

This tone generator and amplifier probe set is used to quickly trace and identify cables or wires within a group and also check the operation of phone lines. It has an important feature that the tone generator has the function of 220V high voltage protection .With proper use and care, this meter will provide many years of reliable service.

## ***Specifications***

Power: 9V battery (tone generator and probe (1 each))

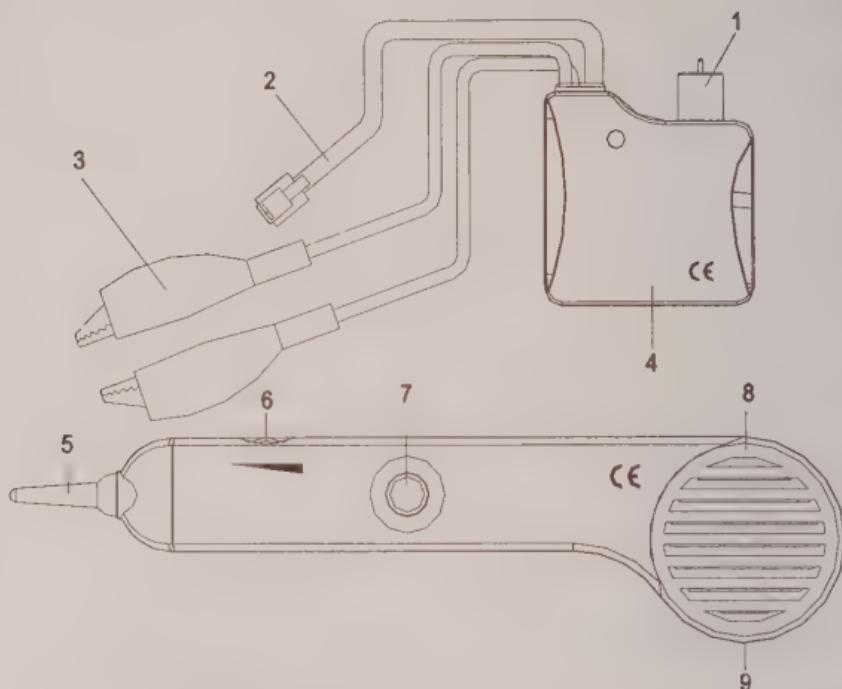
Tone output : 1kHz, 6V square wave (approximately)

Dimensions:

Probe:9x2.25x1(228x57x25.4mm),Generator:2.3x2.3x1.35"  
(58.5x58.5x34.3mm)

Weight : 0.6lb (270gm)

## *Meter Description*



- 1. Power switch**
- 2. Modular connectors**
- 3. Test leads**
- 4. Battery compartment (rear)**
- 5. Probe tip**
- 6. Volume/Sensitivity control**
- 7. Power button**
- 8. Battery compartment (rear)**
- 9. Headphone jack**

# ***Operating Instructions***

## **Cable/Wire tracing**

1. Connect the tone generator to the cable
  - a) For cables terminated at one end, connect the red alligator clip to a wire and the black alligator clip to equipment ground
  - b) For unterminated cables, connect the red alligator clip to one wire and the black alligator clip to another wire.
  - c) For cables with modular connectors, plug the RJ11 connectors directly into the matching cable connectors.
2. Set the tone generator power switch to the TONE position.
3. On the amplifier probe, press and hold the side on/off switch.
4. Hold the insulated probe tip against the wire in question to pick up the signal generated by the tone generator.
5. Rotate the volume/sensitivity control on the top of the probe for the appropriate level and sensitivity to identify and trace the wire.
6. The tone will be the loudest on the wires connected to the tone generator.

**Note:** A headphone jack is located on the bottom of the probe.

## **Identifying telephone cable Tip and Ring – Using Alligator Clips**

1. Switch the tone generator to the OFF position
2. Connect the red test lead to one line and the black lead to the other line.

3. The LED color indicates the connection to the RED test lead as:  
GREEN = Ring side, RED = Tip side.

## **Identifying telephone cable Tip and Ring – Using the RJ-11 Connectors**

1. Switch the tone generator to the OFF position
2. Connect the RJ-11 connector mating cable connector.
3. The LED color indicates the condition of the telephone jack wiring.  
GREEN = Jack wired properly, RED = Jack wired with reversed polarity.

## **Identifying telephone cable Line Condition**

1. Switch the tone generator to the OFF position
2. Connect the red test lead to the RING side and the black test lead to the TIP side.
3. The LED will indicate line condition by:  
GREEN = CLEAR , OFF = BUSY, Flickering YELLOW = RINGING
4. Switch the tone generator power switch to CONT to terminate the call.

## **Continuity testing**

1. Connect the test leads to the wire pair under test.
2. Switch the tone generator to the CONT position.
3. The LED will glow bright GREEN for a low resistance or

continuity. The LED will glow less brightly as the resistance increases and will extinguish at approximately 10,000ohms.

### **Tone selection**

The output of the tone generator can be set to continuous or wobble. To change the type of output, change the tone type switch position (located in the battery compartment)

### **Battery replacement**

Install a new battery by removing the battery cover as indicated in the meter description diagram.



